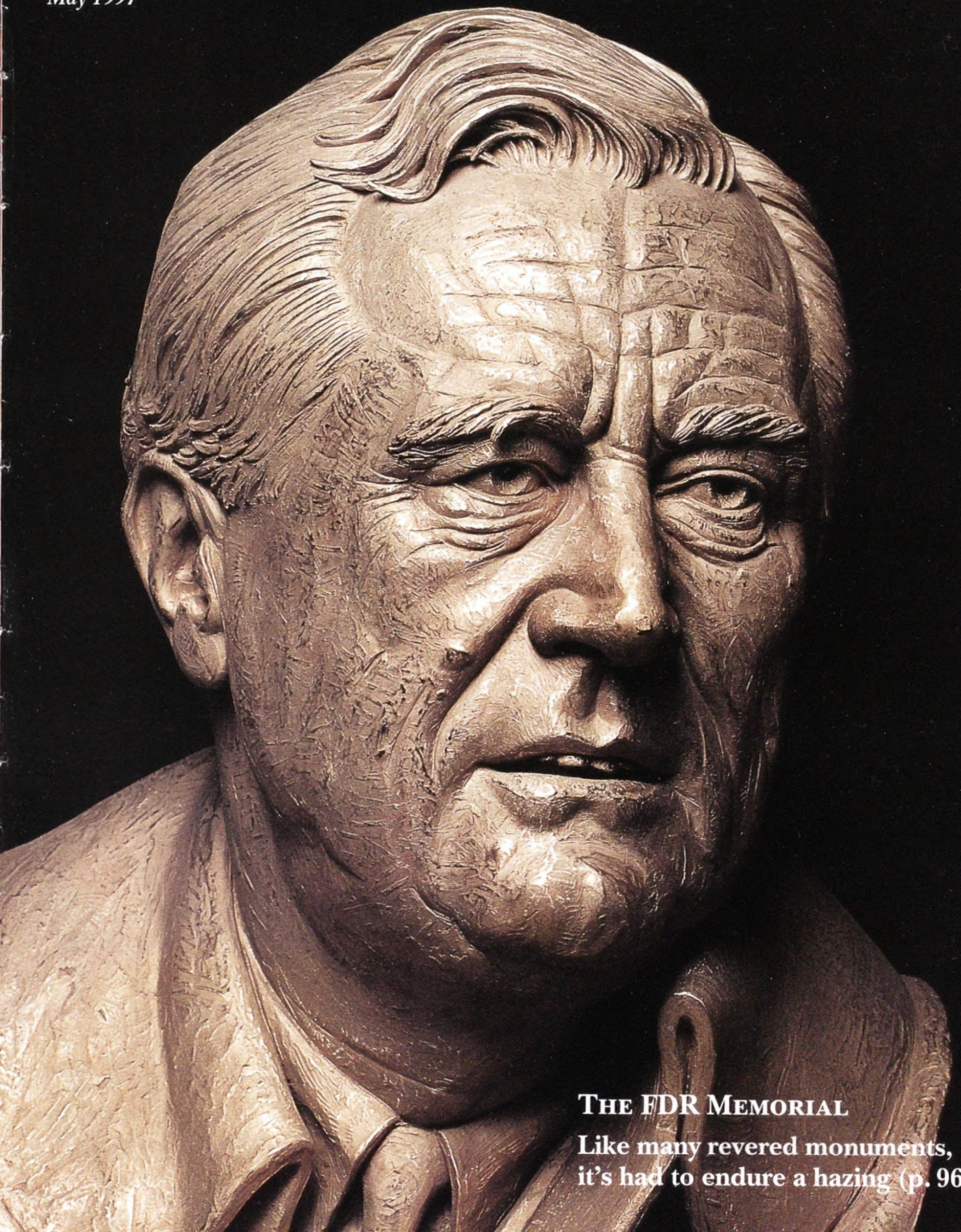
Smithsonian

May 1997



THE FDR MEMORIAL

Like many revered monuments, it's had to endure a hazing (p. 96)

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January 10, 1992:
Chrysler introduces new Jeep® Grand Cherokee. Foreshadowing the impact Grand Cherokee will have on car buyers, Chrysler President Bob Lutz unveils it by driving up the steps and through a plate glass window into the North American International Auto Show in Detroit.

October 30, 1996:
For the second consecutive year, the Car and Driver "Ten Best List" includes multiple Chrysler Corporation vehicles: Chrysler Town & Country, Dodge Caravan, and Plymouth Voyager minivans are honored along with Chrysler Cirrus, Dodge Stratus, and the new 1997 Plymouth Breeze.

October 4, 1996:
Chrysler Corporation reports that the 1996 model year was the most successful in the Company's 72-year history, with a record 2,407,700 vehicles sold.

April 23, 1996:
Strategic Vision releases it Total Quality Award™ winn for "Best Ownership Experien Winning their categories: Dodge Intrepid, Chrysler Town & Country Jeep Grand Cherokee, and Dodge Ram Pickup.

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Visit our World Wide Web site at http://www.chryslercorp.com, or call toll-free 1-888-GREATCARS. *†Always wear your seat belt. Jeep is a registered tradema*
35,652 October-November new vehicle buyers of 200-plus models after the first 90 days of ownership.

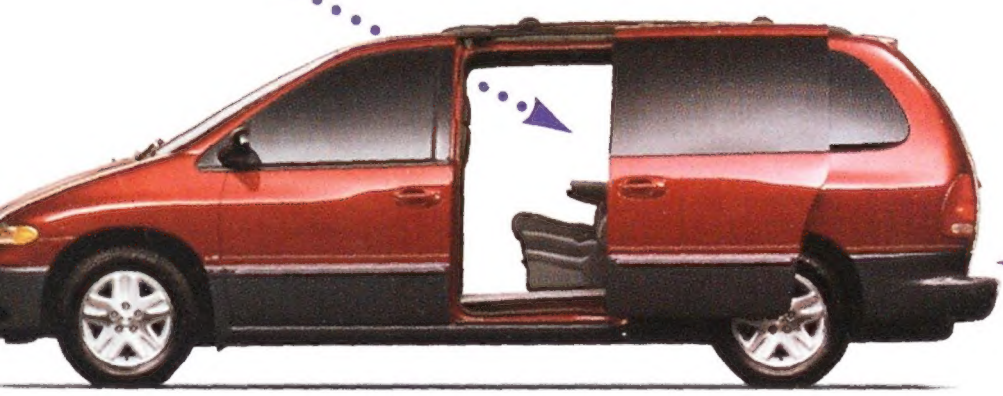
February 20, 1992:
Under the leadership of Chief Engineer Francois Castaing, Chrysler celebrates one year of working in platform teams, multi-disciplinary groups brought together for more innovative, responsive automaking.

September 15, 1992:
A new automotive architecture is born as Chrysler introduces cab-forward design in all-new Chrysler Concorde, Dodge Intrepid, and Eagle Vision.

January 6, 1993:
New Dodge Ram Pickup changes the rules with its aggressive styling and Magnum V10 engine. It's the most powerful engine ever in a pickup.

November 6, 1993:
The new 3.5 million square foot, $1 billion Chrysler Technology Center is now home to 7,000 employees, with state-of-the-art facilities to promote breakthroughs in design, engineering, safety, and manufacturing.

July 15, 1992:
Platform team reads letters from minivan owners asking, "Why not put a sliding door on the driver's side too?"



March 10, 1995:
Redesigned Chrysler, Plymouth, and Dodge minivans reach dealerships with features including dual front air bags,† optional dual sliding doors, and Easy Out Roller Seats.™

March 6, 1994:
Leaders from Chrysler and the United Automobile Workers convene in Orlando for annual conference on quality improvement. Very few attendees return with suntans.

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hrysler Corporation. *Strategic Vision's 1996 Vehicle Experience Study℠ surveyed

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Smithsonian *features*

May 1997
Volume 28, Number 2

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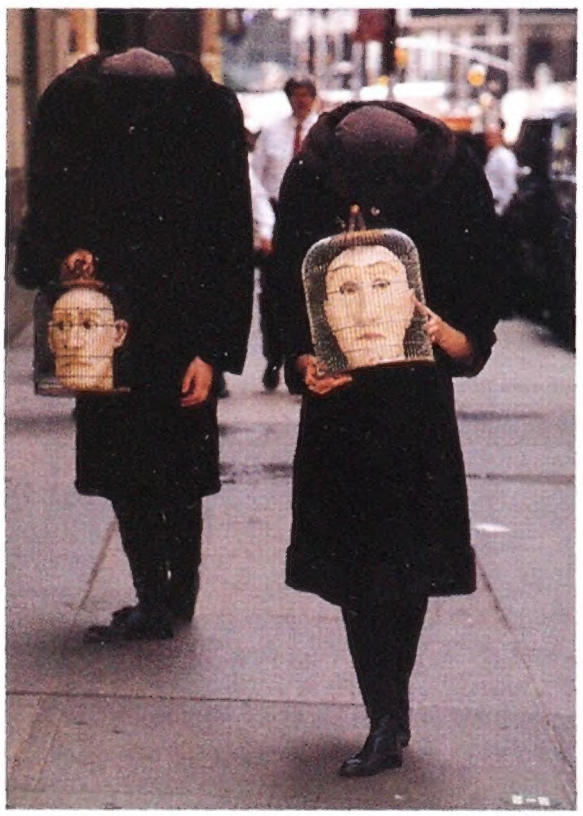

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May 1997
Volume 28, Number 2

Cover

Cover:
In Neil Estern's bronze bust of FDR, for his sculpture at the Franklin Delano Roosevelt Memorial in Washington, D.C., the President appears burdened yet, says Estern, displays the "strength and vigor" that saw the nation through the Depression and World War II (p. 96)
Photograph by Enrico Ferorelli

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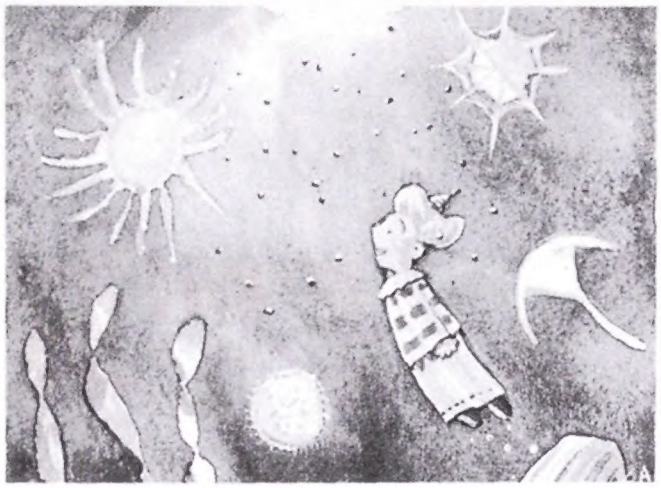
The Wonder of Iron-6



Scientists are researching the possibility that consumption of iron ions by plankton could play an important role in combating global warming.

Iron Saves the World

By Tomoyuki Kohara

There is a marine phenomenon known as "withered seashore." It occurs when the marine plants which normally grow in abundance in coastal seas wither and die, leaving the area barren—almost as if it had been ravaged by a forest fire.

Research has been pointing to one of the causes, the reduction of the iron content in sea water. Iron is known to play a crucial part in plant metabolism by virtue of its role in the transmission of electrons as part of the photosynthetic and respiratory chain.

Iron is being prevented by dams and barriers from being carried down to the sea, and the resultant lack of iron in coastal areas of Japan is a major factor in generating the withered seashore problem. Because the Japanese islands are composed of steep terrain, a large number of debris barriers have had to be erected to prevent natural disasters.

The answer to the problem may well be to sprinkle powdered iron into the sea in order to facilitate plant photosynthesis and thereby regenerate the luxuriant plant life of our seas. This may seem like a crazy idea, but it is in fact currently being considered in all seriousness by the scientific community, not as a means of curing the blight of withered seashores, but as a way of combating global warming.

In 1988, John Martin and Steve Fitzwater of the Moss Landing Marine Laboratories in California made the stunning suggestion that the Antarctic Ocean should be seeded with powdered iron in order to stimulate the growth of vegetable plankton, which would then collect in the surface areas of the ocean. The theory suggested that the plankton would be able to absorb carbon dioxide from the atmosphere and increase its ability to photosynthesize and assist the conversion of carbon dioxide, which plays a major part in global warming, to oxygen and water. Could iron turn out to be the savior of our planet?

About the Author:
Tomoyuki Kohara is a science journalist who is interested in the materials of the life sciences, global environment, and ecosystems. He earned a master's degree from Hokkaido University in piscatology.

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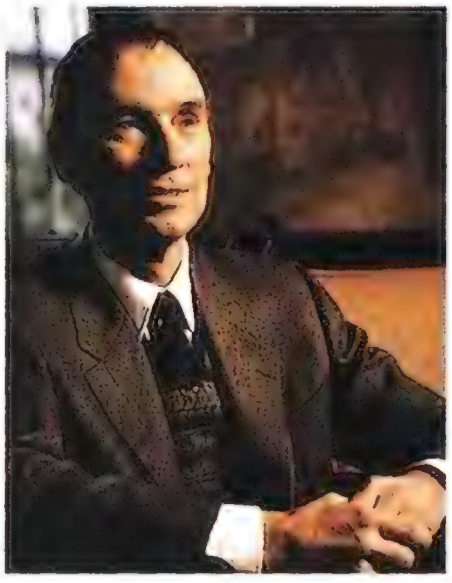
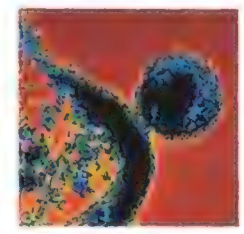
A drug he discovered for transplant patients is now helping millions fight AIDS.



Ken Richardson

"I left high school at age 16 to do odd jobs in a small pharmaceutical lab. Back then I never dreamed that, one day, I would help discover a medicine that would save thousands of lives."

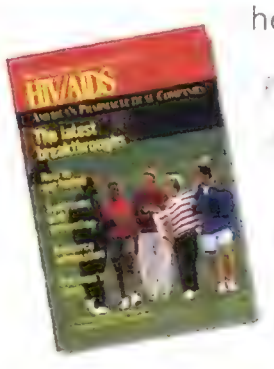
"I loved lab work, so I went back to school at night and worked at the lab during the day. After 12 years, I had my Ph.D. Then I went to work at a pharmaceutical company, where I began research on an anti-fungal medicine to treat deadly infections. For me, a drug saves more than a life. It can save a family."



"Some of the most deadly infections come from fungi in the air we breathe," says Ken Richardson, a pharmaceutical company researcher. "When you have a healthy immune system, it's not a problem."

Richardson and his research team discovered a lifesaving drug in the early 1980s to treat fungal infections in cancer and transplant patients. When thousands of AIDS patients began turning up with fungal infections, they thought their new medicine might help.

"I'll never forget the first time we tried it in an AIDS patient. She was hallucinating from a fungal infection that was damaging her brain," said Richardson. "The doctor gave her our drug and the next day the hallucinations were gone. Two weeks later she left the hospital." Today, the drug Richardson discovered for his company helps millions of people around the world.



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Smithsonian Perspectives

A patriarch of flight, Paul Garber devoted his Smithsonian career to the preservation of historic aircraft

There is nothing fancy or imposing about the National Air and Space Museum's Paul E. Garber Preservation, Restoration and Storage Facility. A collection of windowless, corrugated-metal buildings barely visible behind a tall chain-link fence in the Washington, D.C. suburb of Suitland, Maryland, the place resembles a down-at-the-heels rental storage facility or a low-budget industrial park.

But looks can be deceiving. The Garber Facility is the behind-the-scenes heart and soul of the world's most visited museum. More than a hundred treasures of the age of flight are on view in these nondescript buildings. Visitors who sign up for a docent-led tour of the no-frills Garber displays will see a Curtiss JN-4D "Jenny" essentially untouched since the day in 1918 when U.S. Army Air Service officials turned it over to the Smithsonian; a Sikorsky JRS-1 flying boat that survived the attack on Pearl Harbor; *Caroline*, the Convair 240 that Sen. John F. Kennedy traveled in during his 1960 Presidential campaign, and a score of other aircraft and space vehicles that cannot be seen anywhere else in the world.

Paul Edward Garber (1899-1992) collected more than half of the 352 Smithsonian-owned aircraft on display at the facility named in his honor, at the National Air and Space Museum (NASM) on the Mall and, on loan, at other museums around the world. He fell under the spell of both aviation and the Smithsonian while growing up in Washington, D.C. As a 10-year-old, he took a streetcar across the Potomac to watch Orville Wright fly the world's first military airplane at Fort Myer, Virginia. Alexander Graham Bell, a Smithsonian regent, taught young Paul how to bridle his kite. At the age of 15, Garber built a full-scale biplane glider based on a model he had seen at the Smithsonian. His mother helped him cover the wings with red chintz, after which a group of friends towed him into the air with a clothesline.

Garber joined the Army in 1918, and was about to begin flight training at College Park, Maryland, when the war ended. He took a job as a ground crewman and messenger with the Postal Air Mail Service. But Garber, a talented craftsman and model maker who frequented Smithsonian museums, decided that he could best contribute to the future of aviation by preserving its past.

In 1920, he began working at the Institution, building models and preparing exhibitions. For the next 72 years he dedicated himself to the preservation of the nation's aeronautical heritage and to sharing his boundless enthusiasm for flight with Smithsonian visitors. He played a key role in the creation of the National Air Museum in 1946, and was indispensable in the effort to construct the present National Air and Space Museum building, which opened in 1976. Most important, Garber, as curator and devotee, assembled the most impressive collection of historic aircraft in the world for the Institution.

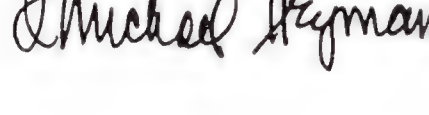
The storage of that collection had not been much of a problem prior to World War II—virtually everything that Garber collected was on display at the Arts and Industries Building or on loan to another museum. But when he returned from service as a naval officer, he faced an entirely new set of problems. Gen. Henry H. "Hap" Arnold, commander of the U.S. Army Air Forces, presented the Smithsonian with a collection of U.S. aircraft that had fought and won the war in the air, along with captured examples of enemy aircraft. When Paul Garber accepted responsibility for this vast collection, it was stored in an abandoned airplane factory in suburban Chicago, now the site of O'Hare Airport. The U.S. Navy had a similar collection of historic aircraft in storage for the Smithsonian at Norfolk, Virginia. The crisis came with the Korean War, when the U.S. Air Force needed the factory and began to force the Smithsonian out the door.

Determined to safely relocate the treasures to the Washington area, Garber searched in vain for empty warehouse space in the neighborhood of the nation's capital. He then persuaded a pilot friend to assist him in conducting an aerial survey of the Maryland and Virginia suburbs from the cockpit of a Piper J-3 Cub. His search revealed 21 acres of woodland in Suitland. The National Park and Planning Commission, which controlled the land, was more than pleased to turn it over to the Smithsonian in 1952.

"When I first went out there and walked around," Garber later commented, "the tree-filled 'wilderness' was just about as the Indians had known it, and my only companions were the bullfrogs and mockingbirds." There was no budget for this project. "I had to scrounge," he recalled with pride.

His powers of persuasion were legendary. Army engineers at nearby Fort Belvoir provided a bulldozer to clear trees and brush from the site. Garber persuaded a local contractor to donate any excess cement remaining aboard his trucks at the end of the workday. Navy officials agreed to provide, at cost, the first of the prefabricated buildings that would soon dot the site.

Paul Garber continued for the rest of his career to "scrounge" for the funds with which to support the preservation and display of the collection, and eventually bequeathed the task to his successors. If all goes well, the new NASM Dulles Center will open its doors in 2001. Although the process will take time, the Dulles Center will eventually replace the Garber Facility, providing much better conditions in which to preserve, store and display the world's finest collection of aeronautical artifacts. You can rest assured, however, that the spirit of Paul Garber will accompany the collection to its new home.



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Bag'N Baggage

Letters to the Editor

Vukovar

I had heard and read news accounts of the exhumation of the bodies in the mass grave at the Croatian city of Vukovar and thought: make the site of the slaughter into a memorial. Leave the corpses and move on. The victims will be no less dead for the efforts to identify their remains, and the doctors' skills can be better used elsewhere to heal the living. Eric Stover's terse, finely written text and Gilles Perres' carefully composed photographs in the March issue, however, revealed to me how insensitive I had been.

The image on the article's closing pages of the grieving women in their gaily printed dresses and scarves conveyed their longing to learn the fate of their brothers, fathers, husbands, sons and other loved ones. I am grateful to you for showing me their faces. I thank you for telling me of the woman who wished for one single bone of her son to treasure. You demonstrated to me that these doctors—Clyde Snow and other forensic anthropologists—are indeed working to heal the living.

Sandra J. W. Valinis
Worthington, Ohio

I am an attorney and was formerly in private practice handling death cases, including arson. I now work for a state court. I have seen many crime scene and autopsy photographs, and I am not unduly squeamish. It is one thing when one is prepared and steeled for photographs showing decomposed and partially mummified remains of the recently dead in the course of one's work. It is quite another, however, to run across them at home with a cup of tea, the cat in the lap and two young children gathered around.

Martha McGhee Glisson
Atlanta, Georgia

I find it a disturbing sign of the times when we must stand by helplessly as people are marched off to their graves, and yet we are allowed to protect their corpses with soldiers and barbed wire while forensic anthropologists identify the remains.

Dennis Shain
Mossyrock, Washington

Elephant orphanage

I was deeply touched by Jim Leachman's picture essay on Daphne Sheldrick's orphanage for baby elephants. Kudos to Sheldrick and her compassionate staff of eight "substitute moms." The photograph of keeper Saya sleeping with orphaned Zoe warmed my heart.

May Mrs. Sheldrick's example be an

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inspiration to all those who labor selflessly for the survival of all living things.
Adrian J. McGuire
Pleasantville, New York

While I have enjoyed many of your articles on the animal kingdom, the photographs of the elephant orphanage have made the greatest impression on me. The most touching picture was that of baby Zoe greeting keeper Atanash Mulei with the tip of her trunk. The love and mutual respect shown on both their faces spoke more than words can say. That these animals are still able to trust and respect us despite all the killing, maiming and habitat-stealing we do is a miracle to behold. I will carry this photograph in my memory for a long time.

Marlane Liddell's text mentions that the orphanage survives on donations. Where can I send mine?
Brenda Smith
San Jose, California
Make checks payable to the David Sheldrick Wildlife Trust and send them to Daphne Sheldrick, David Sheldrick Wildlife Trust, P.O. Box 15555, Nairobi, Kenya. Ed.

The Jeannette

I read with pleasure Donald Dale Jackson's article about the *Jeannette* Arctic expedition. On September 30, 1890, the U.S. Congress passed a resolution to award a special gold medal posthumously to Dr. James M. Ambler for contributing to the survival of many of the *Jeannette*'s crew members.

The medal is on exhibit at the Virginia Historical Society along with the scarf that was found on Ambler's frozen remains, and his diary of the expedition. We recently acquired a contemporary watercolor of the *Jeannette* as it may have looked frozen in ice in the Arctic for 21 months.
James C. Kelly
Assistant Director
Virginia Historical Society
Richmond, Virginia

In 1890 the officers and men of the U.S. Navy dedicated a granite-and-marble monument to the memory of Lieut. George Washington De Long and the crew of the *Jeannette*. Lieut. George P. Colvocoresses designed the monument—a cross with carved icicles hanging from it that sits atop a cairn. The 24-foot-high structure is in the U.S. Naval Academy Cemetery overlooking the Severn River. Fifty years ago my father pointed it out to me and said of the *Jeannette* crew, "Iron men in wooden ships."
Donald J. Shipley sr.
Los Fresnos, Texas

Jeannette Park, which overlooked the East River in downtown Manhattan, was built as a monument to the Arctic steamship, De Long and his 1879 expedition crew of 32. The park, which is located at 77 Water Street, was renamed Vietnam Veterans Plaza to commemorate the tenth anniversary of the end of U.S. hostilities in Southeast Asia. This small plot of ground now holds a plain wall made of glass bricks which are etched with the words that American servicemen wrote while in Vietnam and the news that reached them from home.

By the way, Thomas Edison's first dynamo, or electric generator, was built for the *Jeannette*'s Arctic expedition.
Kenneth Kowald
Richmond Hill, New York

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Not often do illustrations for articles evoke such feeling as those painted by Arthur Shilstone. He applied the watercolor medium to extraordinary use, portraying a terrifyingly frozen world with stunning realism.
Audrey Powell
Arlington, Virginia

American Colony

Jonathan Broder's article on the American Colony in Jerusalem brought back warm memories. I spent a month at the American Colony Hotel in 1951, before its "modernization" a year later. It was interesting and comfortable, and the food was excellent.

Bertha Spafford Vester had recently published *My Jerusalem* for her grandchildren. One evening she and two friends were looking for a fourth for bridge, and I jumped at the chance, hoping to learn more of her history. She quickly dashed my hopes: she was playing bridge, not chatting.
Mary O. Baxter
Marion, Ohio

British actor-turned-soldier Vivian Gilbert served in Gen. Edmund Allenby's forces, and was outside of Jerusalem when the city surrendered on December 9, 1917. He told his friend Lowell Thomas, the war correspondent, that he had pointed the company cook and another soldier toward a village where they might find some food. The two got lost, however, and ran into a group from Jerusalem, including Mayor Hussein Salim al-Husseini, who tried to give the city's keys to the cook. The cook protested, according to Gilbert, saying, "I don't want any keys to any Holy City. All I want is some eggs for my officers."

Next Sergeants Hurcomb and Sedgewick met the group, who were waving Anna Spafford's white bedsheet. The sergeants are generally credited with the surrender, but the mayor later surrendered to Lieutenant Colonel Bayley as well and, finally that day, to Major General Shea, who formally accepted in the name of General Allenby.

Major Gilbert wrote a charming personal narrative of this in *The Romance of the Last Crusade* (1926).
Edward M. Williams
Lansdale, Pennsylvania

There is a sidelight to the tragic loss of Horatio and Anna Spafford's four daughters in the shipwreck of 1873. While traveling to join his wife after the accident, Horatio's ship neared the point at sea where his children perished, and he wrote the words to the hymn "It is Well With My Soul." The first stanza is: "When peace like a river, attendeth my way,/When sorrows like sea billows roll;/Whatever my lot, Thou hast taught me to say,/It is well, it is well with my soul."
Ken Warren
Tulsa, Oklahoma

At an early age, my parents moved with their respective families from the United States to join the American Colony in Jerusalem. My sister, two brothers and I were born there and spent our early years in the Middle East. We left when our parents, and many others, grew sick of the autocratic rule of Bertha Vester and company. I recognize many people in the photograph on your opening spread, including my grandfather, the Reverend Edward Baldwin; my mother, Anita Baldwin Yantiss; and my father, Jess Yantiss.

G. Eric Matson took the picture of the surrender of Jerusalem (p. 122). Uncle Eric owned the Matson Photo Service in Jerusalem for many years, and when he returned to the United States, he gave his vast collection of 20,000 negatives to the Library of Congress. The Matson Collection is housed in the library's Prints and Photographs division.
Alvin C. Yantiss
Fitzwilliam, New Hampshire

Storytellers

I enjoyed Bruce Watson's article on storytelling, but I was especially happy to see Tom Raymond's photograph (p. 61) of Alabama's greatest storyteller. I often hear Kathryn Windham Tucker on the radio, and each tale is a delight. She shares her memories of a gentle South of years ago with humor and liveliness that make the imagination soar.
Beverly H. Lewis
Athens, Alabama

Women photographers

Imagine my surprise when I saw Wendy Snyder MacNeil's photograph of my fondly remembered French teacher, Marie Baratte. Mam'selle, as she was called at Abbot Academy in Andover, Massachusetts, was wonderfully kind and caring. The portrait of Mam'selle that we see in the photograph hung on the wall in her suite at the school. Mam'selle does not appear to have changed between 1954 when I knew her and 1972-73 when Snyder MacNeil took the photograph.
Deborah Huckins
Marblehead, Massachusetts

Around the Mall and Beyond

In Michael Kernan's Mall column I read with dismay food historian Elisabeth Rozin's statement that chicken soup has dubious curative powers. As one who has lived in New England for most of my life, I can testify to the positive value of consuming it when down with a cold. Being of Jewish descent, if I have learned one thing, it is not to disagree with Jewish mothers. If they say that chicken soup is good for a cold, just accept it as fact or they will make your life unbearable. Ms. Rozin: Beware!
Stanley R. Brown
Buzzards Bay, Massachusetts

Last Page

Chris Ganstrom's piece about battling the rocks on his Vermont hilltop farm deserves an afterword. About 1700, the brother of one of my ancestors moved from New England to southern New Jersey. He soon wrote home, urging his relatives to join him because "the fields here do not have rocks." That must have been a potent sales argument before the advent of backhoes and tractors nearly 200 years later.
Rixford A. Beals
Somerset, New Jersey

I am the wife of a "rock man," and I know a lot about them—men who turn rocks, that is. Despite three back operations, my husband continues to go out to our garden with a rototiller, shovel and crowbar to pull rocks out of the ground. I used to get angry with him because of all this madness, but I have given up. I asked him why he has to dig rocks, and he replied, "What else should I be doing?" I am concerned that a rock will one day take him, but then, he'll probably die happy, perhaps even fulfilled from building walls.
Faith Korpinen
East Hampton, Connecticut

Transmit mail to edletters@aol.com or post it to Letters Editor, SMITHSONIAN *magazine, 900 Jefferson Drive, SW, MRC 406, Washington, DC 20560.*

"She's sort of wrinkled
and scowls a lot.
She hasn't stopped
screaming since
the day she arrived.
The dogs are *terrified*."

Around the Mall and Beyond

By Michael Kernan

Rotted and tumbling posts and planks of an ancient footbridge make for beguiling sculpture, especially when the timbers, and even the rusty nails, are made of clay

Taiwanese ceramist Ah-Leon was doing teapots that looked just like tree trunks, but "bigger" kept tempting. Above, a section of his 60-foot-long work called *Bridge.*

As a student of prefixes, I have always been intrigued by the difference between "sur" and "hyper": for instance, between "surrealism" and "hyperrealism."

Ah-Leon trained as a surrealist painter in his native Taiwan, but he wanted his works not merely to comment on reality but to actually achieve its effect. He wanted to create art that was the ultimate illusion of reality: trompe l'oeil in three dimensions.

His first step was to take up ceramics. He made teapots and became very good at it. But this palled on him, too. Teapots were too functional, too much a mere craft. What to do? Well, he had always been fascinated with the wood shapes and patterns in bonsai trees. So he began making teapots that looked like sections of tree trunks, with branches for spouts and handles.

Now, these teapots were trompe l'oeil indeed, and they attracted a lot of attention. In fact Jan Stuart, assistant curator of Chinese art at the Smithsonian's Sackler and Freer galleries, saw one called *Branch Teapot* (p. 20) at a New York dealer and recommended that the Friends of Asian Art, the galleries' membership organization, buy it for the Sackler. She wondered where Ah-Leon was going with his ceramic illusions and wrote him.

"I was getting tired of teapots, even bonsai teapots," the artist recalled. "I wanted something even less traditional. I had made a railroad tie teapot out o clay and made it look as much like wor wood as possible. That was pretty radi cal, but it still didn't go far enough."

In 1987, Ah-Leon came to the Unite States. He's been here many time since, for a year as artist-in-residence a SUNY, Brockport, and as a teacher a pottery schools and workshops acros the country. Ah-Leon is a master in th venerable 400-year-old tradition o unglazed teaware made at the kilns o Yixing near Shanghai. Still, he vows t "study the art of the past hundred gen erations, but not eat ancient rice," as Chinese saying advises. "I started seein the large, sculptural pieces that Ameri can ceramists were doing. They were freer in their ambitions than artists i Taiwan. I remember that one American potter told me that the key to succes was to make a piece shocking. 'Either make it huge or red or gold . . .'" So Ah-Leon started thinking big.

During one visit, he sketched a fish ing pier complete with a bucket o worms, and old fish skeletons. But i had no personal meaning. He sough something that would recall his own rural childhood—he was one of seve children in a family of poor rice farmers

He came up with the dilapidated re mains of an ancient wooden footbridge about 60 feet long and 3 feet wide. An that is what Ah-Leon built. The hun dreds of posts and beams and plank are scored and textured and colored s ingeniously that they look just lik wood. And the old nails, bent and rust ed, look like real iron. Ah-Leon's *Bridg* is hyperrealistic, all right. And pleas note that an all-clay, "wooden" bridge i also, by its very nature, nothing if no surreal. "My kiln is only a yard wide, so had to make *Bridge* in pieces. Each plan took a day to make, and each beam too two days, not counting the firing."

He knew he was doing something spe cial but felt it was presumptuous t think it worthy of the national muse ums of Asian art in the United State the Sackler and the Freer. But Jan Stu art saw a picture and suggested that th Sackler host the world premiere o *Bridge.* In February, I watched Ah-Leo putting it all together for the first time ("Bridge: Illusion in Clay" will be at th Sackler through July 6; visits to Madi son, Wisconsin, and Phoenix, Arizona are also planned.)

My first question was this: How d you move a 60-foot ceramic bridge fro Taipei to Washington? No problem. Th

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46 main beams, hundreds of planks and bushels of nails and fragments were simply packed into wooden boxes that the artist designed. The handsomely stained boxes were neatly divided into sections and padded with foam rubber. And numbered. Everything had to be numbered. There were 32 boxes, which in turn were packed into eight huge crates weighing a total of about 5,000 pounds. Grants from the Art Advisory Council to the Mayor of Taipei and from Taiwan's National Culture and Arts Foundation made the shipping and installation of *Bridge* possible.

Ah-Leon arrived in February to assemble the thing, and he was about half done when I caught up with him. The structure starts off solidly at one end, then collapses in the middle, where water and wind have held sway, then recovers at the far end. Some planks are sun-bleached, others rotted and tumbling. "Here's a place where someone fell through many years ago," Ah-Leon explains. "See these grooves. A heavy wheelbarrow made them after water had softened the wood. But these are just my stories. I made this bridge neutral; it could be anywhere, made of any kind of wood. It's for each viewer's own imagination." With some help from Sackler installers, the artist was drilling and shaving the few hidden wood dowels that he inserted for added strength. (Taiwan has a lot of earthquakes.) "When the beams are up, I'll place the horizontal planks on top in a random way," he told me. "That's not designed in advance."

Ah-Leon recounted the struggles of nearly four years as he experimented with firing techniques and ways to make the pieces fit once fired; the heat of the kiln will reduce 100 centimeters of clay to 84, and as anyone knows who has made even a simple teapot, let alone a bonsai one, getting a lid that still fits the opening after the firing is like winning the lottery.

The first of the five sections took eight months to make, at the rate of one firing a month. After that he got better and faster, keeping a meticulous log of every aspect of each firing and controlling the colors of the unglazed clay—sun-bleached browns for the planks, darker browns, reds and grays for the soggy, rotted beams—by reducing the oxygen in the kiln.

One day back home, Ah-Leon let hi 4-year-old daughter walk on a short ver sion of *Bridge*—but gingerly, for ever high-fired stoneware is just fragile pot tery when you come right down to it *Bridge* is not to be touched, but luckil there is a hands-on display at the Sack ler exhibit where visitors can pick up

Ah-Leon makes deep cuts in clay to create the rough grain in *Branch Teapot* and a splintering plank for *Bridge*.

Picasso opens in the
National Gallery of Art

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plank and marvel at the incredibly realistic grain patterns and knotholes.

The 44-year-old Ah-Leon insists he used to be "just a country bumpkin making teapots." I asked him how he supports his family."There have been sacrifices; we live in a fifth-floor walk-up. Three years ago I told my wife I wanted to stop making salable pieces so I could concentrate on *Bridge*. We took out a loan on our home, so now when I go back, I have to face my financial problems." Fortunately, Ah-Leon's works are always in demand. One like *Branch Teapot* sells for about $10,000.

While you're at the Sackler, you might want to check out the star of the gallery's 1996 acquisitions, a collection of Khmer Empire ceramic vessels dating from the 9th to the 14th centuries. The Khmer Empire ranged over what is now Cambodia, Thailand and Laos.

The gift of the Osborne Hauges and the Victor Hauges of Falls Church, Virginia, they will be on display at least through the end of this year. Nine of the 80 vessels, some in animal and bird forms, some in human shapes, as well as elegantly curving jars, will be shown.

Ceramics curator Louise Cort told me that the Khmer works are some of the most striking examples of glazed ceramics from mainland Southeast Asia."The bottle shapes are interesting," she said. "They can have elephant ears and a trunk. Or they can be praying human forms. The vases are quite dramatic fine curving shapes with a wide mouth, narrow neck, wide body and narrow foot. The Khmer was the largest empire in mainland Southeast Asia and had excellent roads."

So, these pots could be conveniently transported from the kilns to cities all through the area. Perhaps across footbridges made of wood.

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THE HEART OF COMMUNICATION

Phenomena, Comment and Notes

By John P. Wiley jr.

Life not only thrives in the heat and violence of Earth's submarine volcanoes, it may have started there. And at least one other body in the Solar System just might have eruptions on its ocean floor

In the Pacific west of Seattle, a zinc-rich black smoker 7,200 feet down vents fluid heated to 545 degrees F. This scene is only about a foot and a half wide.

Volcanoes erupting in the presence of water—at the bottoms of oceans—not only can be an abode of life but may be where life began on Earth. Astronomers know of another celestial body where there likely are volcanoes erupting underwater. It, too, may be an abode of life. The body in question is not Mars but Europa, one of the four moons of Jupiter first discovered by Galileo Galilei in 1610. It seemed no coincidence that as scientists were throwing these ideas around at a Seattle meeting in February, a spacecraft named *Galileo* was making the closest pass ever above that ice-covered satellite.

The annual meeting of the American Association for the Advancement of Science is where all the sciences, physical and social, come together. A pair of sessions in which oceanographers and astronomers sat in on each other's panels seemed to epitomize everything the association stands for.

They were sessions on the unexpected. Until 1977 textbooks stated that all life on Earth depended on sunlight: plants that metabolize sunlight, animals that eat those plants, and animals that eat those animals. Without sunlight, there would be no web of life. But then we found hydrothermal vents around submarine volcanoes, places where icy bottom water that had seeped into cracks in the underlying rock is heated by the 2,200-degree-Fahrenheit magma and shot back up through the seafloor loaded with minerals. These are the "black smokers" and they are hotbeds of life: giant tube worms, crabs and the like. The whole system exists in the darkness of the deep sea, cut off from sunlight and dependent instead on bacteria that can subsist on the hydrogen sulfide pouring forth. The bacteria are eaten by larger organisms, those in turn by larger, and so on.

There's more to those bacteria than meets the eye. Some are species normally found in ocean water that have simply found a good place to live. But others have been found only around the vents, where the uprushing, superheated water has carried them from their home deep in the rock beneath the sea bottom.

John Delaney of the University of Washington pointed out that oceanographers were finding that volcanoes under the sea could support life at about the same time that astronomers were finding volcanoes throughout the Solar System. Some are monumental. On Mars the dead volcano Olympus Mons rises 17 miles above what would be sea level. Even more exciting is the Jovian moon Io, the Galilean moon closest to the giant planet. There, as many as eight or nine volcanoes are erupting at any one time. In fact, January 1980 was the only time *Scientific American*, *National Geographic* and this magazine all had the same cover: a NASA image of a volcano on Io shooting dust and gases out into space.

Biologists were just as excited about undersea volcanoes as astronomers were about theirs. The newly discovered bacteria, it turns out, are so different from any living thing that we've had to revise our nomenclature. The simple plant and animal kingdoms of my childhood were long gone, to be sure. I was just learning to think in terms of the eight kingdoms my current biology text lists. Now on top of these, we divide life into three domains: eukarya, in which cells have a nucleus; bacteria, in which cells do not; and now the archaea—also

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Cracks crisscross the Jovian moon Europa, above. In close-up at right, ridges in dark band (white arrow) imply crust has been pulled apart, perhaps by subterranean action. Central fractures in horizontal ridges (yellow arrow) suggest the same.

without a nucleus—a large fraction of whose genes are not found in the other two groups.

The chosen name "archaea" is meaningful. Some scientists now think that life would have had a hard time starting on the surface of the Earth. For the first billion or so years of its existence, the planet was bombarded with asteroidal material, some objects so large that the ensuing explosions when they struck would have boiled away the top layer of the oceans. Perhaps, instead, it began on the seafloor. Our best information now is that the first creature on Earth, from which all other life evolved, was a microorganism that lived in 200-degree water, presumably around the vents.

In a separate session on new worlds and old, Thomas Gold of Cornell University pointed out that photosynthesis is a complicated process, and it seems reasonable that life started in some simpler way. Bacteria that can live on sulfur in hydrothermal vents would seem promising. Gold said people ask him how microbial life could have gotten down to the seafloor. The right question, he said, is how did life get up here?

The idea that the same thing could have happened on Europa was first proposed back in 1983. Steven Squyres of Cornell was the lead author on that paper. At the Seattle meeting, he hypothesized that Europa once had a liquid ocean, but that it is now largely frozen. Other researchers have been working out the science in the intervening years, however, and believe that an ocean with submarine volcanoes is still possible, even probable.

Much of Earth's internal heat comes from the radioactive decay of heavy elements. There are radioactive elements within the moons of Jupiter, but much of their heating comes from another source. Volcanism on Io results from the flexing of the solid material of the moon itself. Io is very close to Jupiter and moves in an orbit that is slightly elliptical rather than circular. Thus, at some times it is a bit closer to the planet than it is at others. So Jupiter's powerful gravitational field pulls with varying strength. When Io is closest, it is stretched out at the equator. When it is farther away, the stress relaxes. This constant flexing produces heat. On Io, enough heat is produced to melt rock.

Europa is the next moon out, and it, too, moves in a slightly elliptical orbit. Recent calculations show that it may be stressed enough by Jupiter's pull to generate the heat necessary to melt rock and fuel volcanoes. The gravitational fields of the outer Galilean moons, Ganymede and Callisto, also contribute to the flexing.

We already knew that the surface of Europa is covered with water ice. That this water would be ice was no surprise: the surface temperature is in the neighborhood of –225 degrees (and that's without windchill). But the ice has a story to tell. Eugene Shoemaker of the U.S. Geological Survey says the surface is very young. He bases that assertion on the rarity of craters on Europa. He has catalogued all the known comets that have been captured by Jupiter's gravitational field. Some of those eventually crash into the giant planet (SMITHSONIAN, June 1994) while others hit the Galilean satellites. Knowing what's out there, Shoemaker has calculated the current cratering rate on Europa. The surface should be liberally sprinkled with craters, but it is not. Therefore the surface must be renewing itself. Some parts of its surface show so few craters that Shoemaker estimates they are less than ten million years old.

There's more: the surface is laced with cracks and fissures, some of which look as though they have been pushed apart after forming, as if something—presumably water, possibly in the form of slush—were pushing up from below. This sort of activity would account for the obliteration of old craters. So it just may be that there is enough heat moving up and out of the solid moon to melt the ice from below, or in other words, an ocean of liquid water is hiding under that ice. Under that water, submarine volcanoes may be spewing out the minerals, including sulfides, from which life could arise.

If we wanted to look for life elsewhere in the Solar System (and if we had the money), our best bet might be to send an oceanographer the 400 million miles to Europa where she could drill through the ice and, just maybe, shout "Eureka!" Naturally we would not expect to find any forms of life "higher" than bacteria because we know all the reasons why that is improbable. But there are those white worms and crabs around thermal vents here at home. The undisciplined mind envisions a new world of intelligent crustaceans. Think of the movie possibilities.

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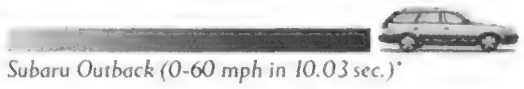

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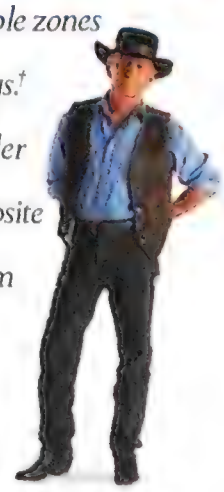
Front Legroom/ Headroom (in.)	40.2/43.3	39.9/42.4	39.5/42.4	37.8/41.4
Pricing	$23,790	$27,380	$26,373	$27,840

Of course, speed isn't the only reason the Subaru Outback is off to such a fast start with car buyers. Its unique hybrid design combines the smooth ride and fuel economy of a passenger sedan with the rugged capabilities of a sport-utility, for a driving adventure like no other. There's also the added security of the Subaru All-Wheel Driving System, which allows the Outback to constantly monitor changing road conditions and transfer power from the wheels that slip to the wheels that grip. You'll find plenty of other safety features, too. Including four-channel ABS, side-impact beams, crumple zones and standard dual air bags.†

So see your Subaru dealer for a test-drive, visit our website at http://www.subaru.com or make a quick call to our toll-free number: 1-800-WANT-AWD. But you'd better step on it. Because these babies really are going fast.



[The New 1997 OUTBACK®]

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*Competitive comparisons based on '96 model year. Outback figures based on '97 model year. Ground clearance comparison based on manufacturer's published specs. Pricing based on '97 MSRP Subaru Outback 4EAT and '96 MSRP for comparably equipped competitive vehicles, not including taxes, license and title fees. Dealer's actual price may vary. Turning stability claim vs. Blazer based on USAC-certified dry lateral acceleration test. 0-60 mph acceleration vs. Explorer with standard V6 engine based on USAC-certified testing. †Always wear seat belts.

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As with all prescription medications, side effects may occur. Always talk to your healthcare provider about any medication you may take. When ZYRTEC tablets were studied, most side effects were mild to moderate. Dose- or treatment-related events included drowsiness (13.7% vs 6.3% for placebo), fatigue (5.9% vs 2.6%), and dry mouth (5.0% vs 2.3%). Only one out of one hundred patients stopped taking ZYRTEC due to drowsiness.

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Please see important information about ZYRTEC tablets and syrup on the following page.

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For Seasonal and Year-round Allergies and Chronic Idiopathic Urticaria.
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BRIEF SUMMARY
ZYRTEC® (CETIRIZINE HYDROCHLORIDE) TABLETS AND SYRUP FOR ORAL USE
(FOR FULL PRESCRIBING INFORMATION, CONSULT PACKAGE INSERT)

CONTRAINDICATIONS ZYRTEC is contraindicated in those patients with a known hypersensitivity to it or any of its ingredients or hydroxyzine. **PRECAUTIONS** Activities Requiring Mental Alertness: In clinical trials, the occurrence of somnolence has been reported in some patients taking ZYRTEC; due caution should therefore be exercised when driving a car or operating potentially dangerous machinery. Concurrent use of ZYRTEC with alcohol or other CNS depressants should be avoided because additional reductions in alertness and additional impairment of CNS performance may occur. **Drug-drug Interactions:** No clinically significant drug interactions have been found with theophylline at a low dose, azithromycin, pseudoephedrine, ketoconazole, or erythromycin. There was a small decrease in the clearance of cetirizine caused by a 400 mg dose of theophylline. It is possible that larger theophylline doses could have a greater effect. **Carcinogenesis, Mutagenesis and Impairment of Fertility:** No evidence of carcinogenicity was observed in a 2-year carcinogenicity study in rats at dietary doses up to 20 mg/kg/day (approximately 10 times the maximum recommended human daily oral dose on a mg/m^2 basis). An increased incidence of benign liver tumors was found in a 2-year carcinogenicity study in male mice at a dietary dose of 16 mg/kg/day (approximately 4 times the maximum recommended human daily oral dose on a mg/m^2 basis). The clinical significance of these findings during long-term use of ZYRTEC is not known. Cetirizine was not mutagenic in the Ames test, and not clastogenic in the human lymphocyte assay, the mouse lymphoma assay, and *in vivo* micronucleus test in rats. No impairment of fertility was found in a fertility and general reproductive performance study in mice at an oral dose of 64 mg/kg/day (approximately 26 times the maximum recommended adult human daily oral dose on a mg/m^2 basis). **Pregnancy Category B:** Cetirizine was not teratogenic in mice, rats and rabbits at oral doses up to 96, 225, and 135 mg/kg/day (or approximately 40, 180, and 215 times the maximum recommended adult human daily oral dose on a mg/m^2 basis), respectively. There are no adequate and well-controlled studies in pregnant women. Because animal studies are not always predictive of human response, ZYRTEC should be used in pregnancy only if clearly needed. **Nursing Mothers:** Retarded pup weight gain was found in mice during lactation when dams were given cetirizine at 96 mg/kg/day (approximately 40 times the maximum recommended adult human daily oral dose on a mg/m^2 basis). Studies in beagle dogs indicate that approximately 3% of the dose is excreted in milk. Cetirizine has been reported to be excreted in human breast milk. Because many drugs are excreted in human milk, use of ZYRTEC in nursing mothers is not recommended. **Geriatric Use:** In placebo-controlled trials, 186 patients aged 65 to 94 years received doses of 5 to 20 mg of ZYRTEC per day. Adverse events were similar in this group to patients under age 65. Subset analysis of efficacy in this group was not done. **Pediatric Use:** The safety of ZYRTEC, at daily doses of 5 or 10 mg, has been demonstrated in 376 pediatric patients 6-11 years of age in placebo-controlled trials lasting up to four weeks and in 254 patients in a non-placebo-controlled 12 week trial. The effectiveness of ZYRTEC for the treatment of seasonal and perennial allergic rhinitis and chronic idiopathic urticaria in this pediatric age group is based on an extrapolation of the demonstrated efficacy of ZYRTEC in adults in these conditions and the likelihood that the disease course, pathophysiology and the drug's effect are substantially similar between these two populations. The recommended doses for the pediatric population are based on a cross-study comparison of the pharmacokinetics and pharmacodynamics of cetirizine in adults and pediatric subjects and on the safety profile of cetirizine in both adults and pediatric patients at doses equal to or higher than the recommended doses. The cetirizine AUC and C_{max} in pediatric subjects 6-11 years of age who received a single dose of 10 mg of cetirizine syrup was estimated to be intermediate between that observed in adults who received a single dose of 10 mg of cetirizine tablets and those who received a single dose of 20 mg of cetirizine tablets. **ADVERSE REACTIONS** Controlled and uncontrolled clinical trials conducted in the United States and Canada included more than 6000 patients aged 12 years and older, with more than 3900 receiving ZYRTEC at doses of 5 to 20 mg per day. The duration of treatment ranged from 1 week to 6 months, with a mean exposure of 30 days. Most adverse reactions reported during therapy with ZYRTEC were mild or moderate. In placebo-controlled trials, the incidence of discontinuations due to adverse reactions in patients receiving ZYRTEC 5 mg or 10 mg was not significantly different from placebo (2.9% vs. 2.4%, respectively). The most common adverse reaction in patients aged 12 years and older that occurred more frequently on ZYRTEC than placebo was somnolence. The incidence of somnolence associated with ZYRTEC was dose related, 6% in placebo, 11% at 5 mg and 14% at 10 mg. Discontinuations due to somnolence for ZYRTEC were uncommon (1.0% on ZYRTEC vs. 0.6% on placebo). Fatigue and dry mouth also appeared to be treatment-related adverse reactions. There were no differences by age, race, gender or by body weight with regard to the incidence of adverse reactions. Table 1 lists adverse experiences in patients aged 12 years and older which were reported for ZYRTEC 5 and 10 mg in controlled clinical trials in the United States and that were more common with ZYRTEC than placebo. **Table 1. Adverse Experiences Reported in Patients aged 12 years and older in Placebo-Controlled United States ZYRTEC Trials (Maximum Dose of 10 mg) at Rates of 2% or Greater (Percent Incidence), ZYRTEC (N=2034) vs Placebo (N=1612) respectively:** Somnolence (13.7% vs 6.3%); Fatigue (5.9% vs 2.6%); Dry Mouth (5.0% vs 2.3%); Pharyngitis (2.0% vs 1.9%); Dizziness (2.0% vs 1.2%). In addition, headache and nausea occurred in more than 2% of the patients, but were more common in placebo patients. Pediatric studies were also conducted with ZYRTEC. More than 1300 pediatric patients (6 to 11 years) with more than 900 treated with ZYRTEC at doses of 1.25 to 10 mg per day were included in controlled and uncontrolled clinical trials conducted in the United States. The duration of treatment ranged from 2 to 12 weeks. The majority of reported adverse reactions reported in pediatric patients (6 to 11 years) with ZYRTEC were mild or moderate. In placebo-controlled trials, the incidence of discontinuations due to adverse reactions in pediatric patients receiving up to ZYRTEC 10 mg was uncommon (0.4% on ZYRTEC vs 1.0% on placebo). Table 2 lists adverse experiences which were reported for ZYRTEC 5 and 10 mg in pediatric patients (6 to 11 years) in placebo-controlled clinical trials in the United States and were more common with ZYRTEC than placebo. Of these, abdominal pain was considered treatment-related and somnolence appeared to be dose related. 1.3% in placebo, 1.9% at 5 mg and 4.2% at 10 mg. **Table 2. Adverse Experiences Reported in Pediatric Patients (6 to 11 years) in Placebo-Controlled United States ZYRTEC Trials (5 or 10 mg dose) Which Occurred at a Frequency of ≥ 2% in Either the 5 mg or the 10 mg ZYRTEC Group, and More Frequently Than in the Placebo Group. ZYRTEC 5 mg (N=161), 10 mg (N=215) vs Placebo (N=309):** Headache (11.0%, 5 mg; 14.0%, 10 mg; 12.3%, placebo); Pharyngitis (6.2%, 5 mg; 2.8%, 10 mg; 2.9%, placebo); Abdominal pain (4.4%, 5 mg; 5.6%, 10 mg; 1.9%, placebo); Coughing (4.4%, 5 mg; 2.8%, 10 mg; 3.9%, placebo); Somnolence (1.9%, 5 mg; 4.2%, 10 mg; 1.3%, placebo); Diarrhea (3.1%, 5 mg; 1.9%, 10 mg; 1.3%, placebo); Epistaxis (3.7%, 5 mg; 1.9%, 10 mg; 2.9%, placebo); Bronchospasm (3.1%, 5 mg; 1.9%, 10 mg; 1.9%, placebo); Nausea (1.9%, 5 mg; 2.8%, 10 mg; 1.9%, placebo); Vomiting (2.5%, 5 mg; 2.3%, 10 mg; 1.0%, placebo). The following events were observed infrequently (less than 2%), in either 3982 adults and children 12 years and older or in 659 pediatric (6 to 11 years) patients who received ZYRTEC in U.S. trials, including an open adult study of six months duration; a causal relationship with ZYRTEC administration has not been established. **Autonomic Nervous System:** anorexia, urinary retention, flushing, increased salivation, dry mouth. **Cardiovascular:** palpitation, tachycardia, hypertension, cardiac failure. **Central and Peripheral Nervous Systems:** paresthesia, confusion, hyperkinesia, hypertonia, migraine, tremor, vertigo, leg cramps, ataxia, dysphonia, abnormal coordination, hyperesthesia, hypoesthesia, myelitis, paralysis, ptosis, twitching, visual field defect, syncope, dizziness. **Gastrointestinal:** increased appetite, dyspepsia, abdominal pain, diarrhea, flatulence, constipation, vomiting, ulcerative stomatitis, aggravated tooth caries, stomatitis, tongue discoloration, tongue edema, gastritis, rectal hemorrhage, hemorrhoids, melena, abnormal hepatic function, eructation. **Genitourinary:** polyuria, urinary tract infection, cystitis, dysuria, hematuria, micturition frequency, urinary incontinence. **Hearing and Vestibular:** earache, tinnitus, deafness, ototoxicity. **Metabolic/Nutritional:** thirst, dehydration, diabetes mellitus. **Musculoskeletal:** myalgia, arthralgia, arthrosis, arthritis, muscle weakness. **Psychiatric:** insomnia, sleep disorder, nervousness, depression, emotional lability, impaired concentration, anxiety, depersonalization, paroniria, abnormal thinking, agitation, amnesia, decreased libido, euphoria. **Respiratory System:** epistaxis, rhinitis, coughing, bronchospasm, dyspnea, upper respiratory tract infection, hyperventilation, sinusitis, increased sputum, bronchitis, pneumonia, respiratory disorder. **Reproductive:** dysmenorrhea, female breast pain, intermenstrual bleeding, leukorrhea, menorrhagia, vaginitis. **Reticuloendothelial:** lymphadenopathy. **Skin:** pruritus, rash, dry skin, urticaria, acne, dermatitis, erythematous rash, increased sweating, alopecia, angioedema, furunculosis, bullous eruption, eczema, hyperkeratosis, hypertrichosis, photosensitivity reaction, photosensitivity toxic reaction, maculopapular rash, seborrhea, purpura, skin disorder, skin nodule. **Special Senses:** taste perversion, taste loss, parosmia. **Vision:** blindness, loss of accommodation, eye pain, conjunctivitis, xerophthalmia, glaucoma, ocular hemorrhage. **Body as a Whole:** Increased weight, back pain, malaise, fever, asthenia, generalized edema, periorbital edema, peripheral edema, rigors, leg edema, face edema, hot flashes, enlarged abdomen, nasal polyp, pain, pallor, chest pain, accidental injury. Occasional instances of transient, reversible hepatic transaminase elevations have occurred during cetirizine therapy. A single case of possible drug-induced hepatitis with significant transaminase elevation (500 to 1000 IU/L) and elevated bilirubin has been reported. In foreign marketing experience the following additional rare, but potential severe adverse events have been reported: hemolytic anemia, thrombocytopenia, orofacial dyskinesia, severe hypotension, anaphylaxis, hepatitis, glomerulonephritis, stillbirth, and cholestasis. **DRUG ABUSE AND DEPENDENCE** There is no information to indicate that abuse or dependency occurs with ZYRTEC. **OVERDOSAGE** Overdosage has been reported with ZYRTEC. In one adult patient who took 150 mg of ZYRTEC, the patient was somnolent but did not display any other clinical signs or abnormal blood chemistry or hematology results. In an 18-month-old pediatric patient who took an overdose of ZYRTEC (approximately 180 mg), restlessness and irritability were observed initially, this was followed by drowsiness. Should overdose occur, treatment should be symptomatic or supportive, taking into account any concomitantly ingested medications. There is no known specific antidote to ZYRTEC. ZYRTEC is not effectively removed by dialysis, and dialysis will be ineffective unless a dialyzable agent has been concomitantly ingested. The acute minimal lethal oral doses in mice and rats were 237 and 562 mg/kg, respectively (approximately 55 and 265 times the maximum recommended human daily oral dose on a mg/m^2 basis). In rodents, the target of acute toxicity was the central nervous system, and the target of multiple-dose toxicity was the liver. **DOSAGE AND ADMINISTRATION Adults and Children 12 years and older:** The recommended initial dose of ZYRTEC is 5 or 10 mg per day in adults and children 12 years and older, depending on symptom severity. Most patients in clinical trials started at 10 mg. ZYRTEC is given as a single daily dose, with or without food. The time of administration may be varied to suit individual patient needs. In patients with decreased renal function (creatinine clearance 11-31 mL/min), patients on hemodialysis (creatinine clearance less than 7 mL/min), and in hepatically impaired patients, a dose of 5 mg once daily is recommended. **Children 6 to 11 years:** The recommended initial dose of ZYRTEC in children aged 6 to 11 years is 5 or 10 mg (1 or 2 teaspoons) once daily depending on symptom severity. The time of administration may be varied to suit individual patient needs. Cetirizine is licensed from UCB Pharma, Inc.

Printed in U.S.A. 70-4573-00-1 Revised September 1996

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Smithsonian Highlights

Planning a Smithsonian visit?

Receive a free Associates' planning packet. Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call 202-357-2700 (voice) or 202-357-1729 (TTY), 9 A.M. - 5 P.M., Monday - Friday, and 10 A.M. - 4 P.M., Saturday-Sunday. *Note*: Parking near the Smithsonian is limited. The Metrorail subway system is convenient to all museums (details in packet).

Begin your visit at the Smithsonian Information Center's Associates' Reception Desk—open 9 A.M. - 4 P.M. daily—in the Castle. Special materials await you there. The National Air and Space Museum's Wright Place restaurant, open 11:30 A.M. - 3 P.M. daily, offers Associates a discount on table service.

The Smithsonian home page on the World Wide Web (http://www.si.edu) offers on-line information about exhibitions, collections, events, research and products.

Museum Hours

Smithsonian museums are generally open 10 A.M. - 5:30 P.M. daily, except December 25. Hours at the National Zoo are 10 A.M. - 6 P.M. daily for buildings, and 6 A.M. - 8 P.M. for grounds, starting May 1.

Special May Exhibitions, Events

National Museum of American Art

Singular Impressions: The Monotype in America (through August 3) The work of artists who have explored the monotype process. See *Highlights Continued*, page 30.

Watercolors Between World Wars: Selections from the Collection (May 16-October 12) Works by such artists as Man Ray, Stuart Davis and Edward Hopper.

The Bard Brothers: Painting America Under Steam and Sail (May 30-September 28) Marine scenes, from the 1820s to the 1890s, by James and John Bard.

Renwick Gallery

The Renwick at Twenty-Five (through July 13) Show celebrating the Renwick's 25th anniversary features some of the finest achievements in recent craft.

National Air and Space Museum

Space Race (opens May 16) New permanent exhibition traces the competition in space between the United States and the former Soviet Union.

Cosmic Voyage (10:45 A.M., 12:55, 3:05 and 5 P.M. daily) Imax film takes viewers on a journey through the Universe.

National Museum of Natural History
Poles Apart: Parallel Visions of the Arctic and Antarctic (through August 4) Photographs by Galen Rowell.
Gems and Minerals Hall Gallery is closed for renovation until September 1997.

National Zoological Park
Think Tank Permanent installation explores the biology and evolution of animal thinking, focusing on orangutans.

National Museum of American History
Audubon & the Smithsonian (May 21-May 1, 1998) Exhibition in the Smithsonian Institution Libraries gallery looks at the life and work of naturalist-artist John James Audubon (1785-1851).

National Postal Museum (Next to Union Station on Capitol Hill)
Under Cover: The Evolution of the American Envelope (opens May 6) Exhibition examines the manufacture of envelopes.

Freer Gallery of Art
Crosscurrents in Chinese and Islamic Ceramics (through July 1) Show illustrates the interaction between Chinese ceramics and Islamic decorative arts.

Arthur M. Sackler Gallery
The Jewel and the Rose: Art for Shah-Jahan (May 4-February 1998) Exhibition highlights the splendor of Indian artistic expression during the reign (1627-58) of Shah-Jahan, builder of the Taj Mahal.
King of the World: A Mughal Manuscript from the Royal Library, Windsor Castle (May 18-October 13) Manuscript chronicles first decade of Shah-Jahan's reign.
Bridge: Illusion in Clay (through July 6) See *Around the Mall*, p. 18.

National Museum of African Art
Adire: Resist-Dyed Cloths of the Yoruba (through August 17) Indigo resist-dyed textiles from southwestern Nigeria.

National Portrait Gallery
Red, Hot & Blue: A Salute to American Musicals (through July 6) Exhibition spotlights the major personalities who created the American musical theater.

Hirshhorn Museum & Sculpture Garden
The Collection in Context: Raymond Duchamp-Villon's "Horse" (May 23-November 30) Presentation explores how the work of this French sculptor (1876-1918) echoed his response to the machine.

Arts and Industries Building
The Jazz Age in Paris, 1914-1940 (through July 13) SITES show takes a look at early jazz movement.
Stories of the People (through August 10) Artifacts from the collection of the National Museum of the American Indian.

S. Dillon Ripley Center, International Gallery
American Voices: Latino Photographers in the United States (May 16-September 28) Show features works by top Latino artists.

Anacostia Museum
Museum Renovation The museum is closed until the fall of 1997.

Heye Center, National Museum of the American Indian (New York City)
Always Getting Ready—Upterrlainarluta: Yup'ik Eskimo Subsistence in Southwest Alaska (through June 8) Photographs (1973-92) by James Barker.

Cooper-Hewitt, National Design Museum (New York City)
Disegno: Italian Renaissance Designs for the Decorative Arts (through May 18) Renaissance concepts of design.

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There are wonderful books. Superb documentaries. But to truly understand this incredible man, nothing replaces walking through Monticello, Colonial Williamsburg or Thomas Jefferson's Poplar Forest. Nothing comes close to exploring the Barboursville Vineyards, Natural Bridge or Tuckahoe Plantation. To know Jefferson, you must visit JEFFERSON'S VIRGINIA. And the best way to do that is to follow the JEFFERSON'S VIRGINIA driving tour, which takes you, site by site, through his remarkable life. Other fascinating sites include the Virginia State Capitol, the University of Virginia, The College of William & Mary and many others. For more information and accommodations, please call (888) 293-1776; for additional travel packages, call (888) 742-4666. J-06

VIRGINIA IS FOR LOVERS
TRAVEL GUIDE

A singular form of lasting impressions

In the latter part of the 19th century, American artists began experimenting with a new printmaking medium. Used in Europe as early as the 17th century, the process was given the name "monotype" by American painter Charles Alvah Walker. Noted for its freedom and directness of expression, the technique entailed drawing or painting an image on a metal plate or other surface, then transferring that image through pressure to a sheet of paper, producing a single, mirror-image impression. The first comprehensive exhibition of these monotypes is now at the National Museum of American Art. On view through August 3, "Singular Impressions: The Monotype in America" features works by artists from Maurice Prendergast to Jasper Johns. "At every stage," says the show's curator Joann Moser, "I considered why artists made monotypes. All seemed to find the same qualities appealing: its spontaneity, its potential for chance effects and its flexibility. The process has added a new chapter to the history of modern American printmaking." *Diane M. Bolz*

An early practitioner of the monotype in America, actor-artist Joseph Jefferson created this untitled landscape c. 1885. In *Palette Still Life #53* (top), from 1982, Michael Mazur reflects on the monotype process.

This is when Roger told our parents not to count on him for any financial support.

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By Kevin Krajick

Mining the scrap heap for treasure

Giant crane grapples with debris at Denbo Iron & Metal; blue feeder will send the load to the shredder.

Across America, a network of scrap-metal firms is supplying much of the raw materials, iron to aluminum, that fuel the growing global economy

Drive a mile or two west out of the small city of Decatur, Alabama, along the Tennessee River, past abandoned cotton fields and factories, and right near the Price Nelson Barbecue you'll come to Denbo Iron & Metal Co., Inc. You can't miss it: 60 acres piled three and four stories high with smashed autos, refrigerators, pipes, siding, water heaters. In one section lie 20,000 tons of machinery, steel floors and everything else metal that once was a Reynolds Metals plant.

Much of it is unidentifiable chunks, but occasionally you'll see a trace of some discarded life. A rusted mailbox—No. 21A. A child's red wagon with all four wheels. A 1962 penny. The whole thing is laced with roads of ankle-deep mud, masked men with sparking acetylene torches, and diesel cranes roaring around like 40-foot-high praying mantises that grab up and drop crushing loads of metal. To most folks this is a junkyard—a dead-end place with no value, history or nice scenery. A sort of 20th-century Hieronymus Bosch preview of hell.

If you think that, walk through the chain-link gate (make sure you wear your old clothes and heavy boots) and meet 70-year-old Morley Denbo and son, Joel, 43, second- and third-generation scrap-metal men, respectively. Far from worthless dumping grounds, places like this are central fountains of industrial power, founded on bittersweet rags-to-riches family sagas that trace American history in exquisite detail. Some people think they are beautiful.

With sledgehammers and giant machines that shred whole autos in a blink, the Denbos and thousands of other scrap "processors" are part of a system that supplies nearly half the nation's iron, steel and copper, 55 percent of the lead, a third of the aluminum, plus assorted titanium, zinc, molybdenum—each year, more than 60 million tons gathered from an intricate web of suppliers, sorted out, chopped up, bundled and sold to mills. There, it is remelted back into the stuff of toasters, cars and bridges. Without these scrap processors there would be no industrial America—or Taiwan or Turkey or Japan, who feed on their harvest to the tune of $3 billion to $5 billion a year in exports alone.

In the 1990s, this trade should, of course, be run just like everything else of global scale and influence: by giant international corporations. It's not. It is run largely by families like the Denbos, most of whom started out long ago as hungry immigrants, unafraid of getting dirt on their hands, owning only their own street smarts and maybe a wheelbarrow. Energetic small entrepreneurs are still coming into the business. But tough environmental laws and big-capital buyouts, along with the simple desires of many scrapmen's grandkids to just do something else, may grind this culture like a batch of old autos into the corporate maw. For now, says cigar-chomping, hard-hatted Joel Denbo, "it's one of the last old trader businesses, where you live by your own guile

Photographs by Kay Chernush

From his office at family's Alabama firm, founded 1907, Morley Denbo deals with clients from Texas to Tokyo.

Morley's son, Joel, supervises operations in the yard; here, he chats with a driver hauling in scrap for sale.

Comptroller Betty Cowart, conferring with colleague Foster Bailey jr., has been with Denbo for 40 years.

and tenacity, by seeing the value in something others don't want and extracting it."

I got my own first taste of the value of scrap five years ago when my brothers and I tore down a junky modern addition to my old farmhouse in rural Schoharie County in upstate New York. Out of the crumbling walls came armfuls of ruined copper wire and pipe, and on a tip from a friendly plumber, I drove this particular part of the mess down to a nearby scrapyard. The owner weighed it up—52 pounds—and I walked out $46.80 richer. Hey, I realized: this stuff is worth something.

This is no big revelation for those in the know. Metals prices move with global economics, but as I write this, you can take broken aluminum lawn chairs to your nearest scrapman and he'll give you 35 cents a pound. Brass plumbing fetches around 50 cents, copper wire without insulation, 85 cents. Ferrous metals—steel and iron—are a lot harder work: $1 to $5 for 100 pounds, depending on the grade and whether they're attached to some undesirable substance such as plastic.

When the Hebrew prophet Isaiah said we shall beat our swords into plowshares and spears into scythes, he spoke the truth: metal has always been recycled without eco-conscious prodding, because it is worth something. In the Westminster Palace of the 14th century, one Geoffrey Chaucer, clerk of the king's works, is said to have collected and inventoried scrap metal. Massachusetts silversmith Paul Revere advertised in broadsides for all kinds of scrap. More than 800 years after it was felled by an earthquake, the bronze Colossus of Rhodes was dismantled by plunderers and allegedly made into weapons.

Trading in scrap is not the oldest profession, for during most of civilization there wasn't enough around to make a full-time living at it; the Industrial Revolution introduced a critical mass. Sadly, says Morley Denbo, who is something of a historian, war often provided a starting point. The earliest true dealer he can identify in America is Cline and Bernheim (now part of Steiner-Liff Iron & Metal Co.). The Nashville firm was hired by Union forces to cart away acres of smashed metal wagon wheels, cannon, canteens and bayonets after the 1864 battles of Franklin and Nashville. The Confederates lost both times. The debris went to nearby foundries. Some 13,000 soldiers on both sides lay dead or wounded.

Many families who run today's trade arrived in the great European migrations from the 1880s to the early 1900s. Certain groups gravitated to the trade—mainly Eastern European Jews, and some Italians. Most knew nothing about metal—they came as farmers or grocers—and started by recycling any castoffs they could find. Larry Fox, a fifth-generation dealer in San Jose, California, says his great-great-granduncles came in 1886 from Hungary and collected burlap sacks and bottles for cleaning and resale. "It was something you could get into with very little capital," he says. "Settlement was

At Denbo, an operator oversees the double magnetic separation system. This monster mechanism segregates ferrous metals, carried away via the conveyor at top; non-iron materials depart on the conveyors at left.

so new there wasn't a lot of used metal." Fox, his father, uncle and other family members still run Markovits & Fox, recycling scrap, including discarded electronic components from nearby Silicon Valley that are passed on to specialists in precious-metals extraction.

The Denbos' own family history is characteristic of the trade. In 1903, Morley's uncle Ben came to New York from the Lithuanian shtetl of Bupt and moved South. Ben's brother Isaac "Granddaddy Ike" Denbo, Morley's father, followed in 1907. The family had run a store and dairy in Bupt, but now in the Deep South with no money and strange accents, the brothers turned to peddling. They drove a horse and wagon farm to farm, trading mules, buying and reselling eggs, walnuts and ginseng, and bartering for mink, possum and skunk furs—as well as such recyclables as broken plowpoints, horseshoes and even cattle bones, resold for rendering. "They had a big cage where they used to recycle old, smelly feathers from feather beds," says Morley. "You'd blow in air to make them all nice again, and stuff them into new ticks. You did any damn thing to survive back then."

In 1917, Ike left to fight for his new country in World War I, selling his business to his best friend, another immigrant, Louis Miller. Louis' grandson still runs Ike's original firm in Huntsville, Alabama; the Denbo kids grew up playing with the Miller kids, and some 60 years later Sara Miller, Louis' granddaughter, married Joel, Ike's grandson. They have three daughters.

After the war, Ike restarted his business in Pulaski, Tennessee, just north of Ben's place in Decatur. Gradually the trade in bones, bottles and fur fell off as industrialization took over and more metal arrived. In Ike's case, much scrap came with an exodus of farm families fleeing the 1930s Dust Bowl down U.S. Highway 31 through Tennessee and Alabama, toward the greener pastures of Florida. If they made it, many of their jalopies did not. Ike, located on the highway, bought the broken vehicles, dismembered them with sledgehammer and ax, and pushed them in a wheelbarrow up a plank and into a Louisville & Nashville railcar. "Daddy didn't make any money on that," explains Morley. "He usually felt so bad, he bought the families a meal and a room for the night at the hotel." Ike also bought old canning jars and smashed them with a hammer to retrieve the zinc

lids that held the glass tops—one of Morley's first jobs. With his practiced eye, by age 13 Morley was directing hired men sorting out myriad nonferrous items.

World War II propelled thousands of little yards like this into a mighty industry. At the most desperate hour, Boy Scouts and housewives collected everything metal, even foil from inside cigarette and chewing-gum packs. The government contracted scrap dealers to broker the flood—100,000 pounds some weeks at Ike's, an unheard of amount back then. Everything went, even the prized Civil War cannon from Alabama courthouse squares. Morley remembers one afternoon in 1942 when a farm couple arrived in a pickup truck. In back were their parents' zinc grave markers. "They had three sons in the war," he says. "Do you think people would do that today?" The markers went up the plank and into the railcar.

Denbo's state-of-the-art shredder can render an automobile into fist-size chunks in under a minute.

Morley served in the Navy, then married—another scrapman's daughter, of course—and later bought Uncle Ben's business in Decatur. The industry grew by leaps as warships and tanks became the stuff of interstate highways and shopping malls. But the postwar crop was also bitter. For one thing, the Denbos, along with many Jewish families, learned the fate of their loved ones. Bupt had been liquidated in the Holocaust, along with 18 Denbos. No new cousins would ever come over.

The Best Years of Our Lives, the 1946 film about the troubles of returning soldiers, has an unforgettable scene in which a young ex-flier visits a great graveyard of warplanes; as he climbs into a cockpit, memories of combat wrench his body and heart. The scrapman on the site orders him out—the planes are his property now. The flyer recovers his soul by hiring on to help tear the machines apart. Swords into plowshares.

New methods speeded the reprocessing and boosted profits. At Denbo, axes and hammers were replaced with big power shears; backbreaking wheelbarrow labor with cranes. In 1959, the Proler scrap firm in Houston—founded by father Ben, and at that time run by sons Sammy, Hymie, Izzie and Jackie—came up with the Prolerizer, the first machine to chew whole autos into fist-size chunks. Shredders were honed until, in the 1970s and '80s, they single-handedly devoured the countless hulks left clogging the roadsides when hand demolition became too costly. Today, 95 percent of all junked autos are recycled—the biggest single scrap-steel source.

Recycling efforts resurgent

A growing interest in the environment has routed more material to yards, too. In recent years 18 states and many towns have banned the discarding of refrigerators, washers and other white goods in landfills; 75 percent of this junk was recycled in 1995, up from 32 percent in 1990. Recycling of municipal trash has tripled since 1985. Sixty-two percent of all aluminum cans and 56 percent of steel cans are recycled.

Even steelmaking is more scrap-friendly. Commonly used furnaces need 75 percent virgin ore for each batch of steel. But since the '80s, electric-arc models using nearly 100 percent scrap have come on line and now account for 40 percent of production. The Denbos are perfectly positioned again: a $500-million ultramodern electric mill has opened ten minutes down the road.

With more than 100 employees and dozens of giant machines, the Denbos can go through as much as 200,000 pounds of metal in an hour. "Oh, they're a local legend," an antique dealer told me at his Decatur shop. "They made a fortune out of junk." Some employees, like Betty Cowart—"Miss Betty"—the comptroller, or Gerald Yeager, an equipment operator and a onetime

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During World War II, all scrap metal, even a child's toy streetcar, was essential fodder for munitions makers.

wheelbarrow pusher, have been around 30 or 40 years. Joel left to get a B.A. in business in Texas; he knows how to run and fix everything. "You have to crawl around in waist-high muck sometimes to do it," he says. True to tradition, Denbo buys most any metal from anyone—at least anyone who does not play dirty tricks, like weighting aluminum cans with gravel or pawning stolen goods. (Chicanery skyrockets whenever some metal's price goes up. Electric cables—a favorite target—have electrocuted would-be thieves in Philadelphia. From Houston to Denver, traffic signs, fire-hydrant parts and manhole covers vanish. Once, someone stole two-thirds of the aluminum-sided Dunk 'N Dine eatery in Atlanta.)

Metal suppliers come in as many varieties as rain-forest butterflies. The smallest range from car owners who show up with deceased lead batteries to Cub Scouts with empty soda cans. A little farther up the scale are tradesmen who sell leftovers: plumbers with broken toilet flushometers, locksmiths with used brass strikers and doorknobs. The country's 12,000-some auto dismantlers—whose junkyards are often confused with scrapyards—are a separate cottage industry, stripping old vehicles of reusable parts and selling the hulks as scrap.

Some entrepreneurs roam county to county with mobile crushers, charging dismantlers to squash cars for cheaper shipment, or buying them for resale. Other specialists broker only catalytic converters, containing a tidy $15 to $20 of palladium each. Joel assured me that a few low-tech collectors like Ben and Ike remain, knocking on doors for dead lawn mowers and old washtubs. In the trade, they are still called "peddlers."

Most days at the yard now, small-time contributions are dwarfed by items from industries and governments: warehouses of Vietnam-era helicopter parts auctioned by the Department of Defense; turbines from the Tennessee Valley Authority; part of a Saturn V rocket from the space program in Huntsville. ("Probably the biggest piece of aluminum ever recycled," says Morley.)

At any scrapyard, fantastic finds

Fabulous cornucopia is everyday inventory; at a scrapyard in New York City one day, I came across a 55-gallon drum full of $1 gaming tokens from El Embajador Casino in the Dominican Republic. This is all "obsolete" scrap—manufactured items used and discarded. Then there is "prompt" scrap—coils, grindings, stampings, borings and turnings that fall to factory floors in the process of manufacturing everything from ball bearings to auto-body panels. Fifteen percent of ferrous scrap and 50 percent of aluminum scrap is prompt. With more plants opening around Decatur, truckload after truckload of this material rolls in daily at Denbo.

"We don't just take stuff in and send it out," Joel told me as we walked around. "You have to know what it is, what it's worth, how to hook it up with the right customer." It took him years to distinguish valuable tungsten carbide from other metals, desirable nonlead solder from low-grade lead types. Ferrous items typically are sorted into 15 alloys and grades, nonferrous into more than 100, and all are "prepared" in various ways.

In the nonferrous section, a worker strips aluminum screen doors of steel parts. Four laborers work a machine that pulls insulation off thick copper cable. Sorted items are stacked in bins or molded into 1,200- to 7,000-pound bales by a giant press. A quarter-acre near a rail siding is covered with electric motors to be shipped abroad; Denbo can't hand-dismantle them cheaply enough, but the Chinese pay for this privilege.

Out back, ferrous objects are sorted and chopped into progressively smaller pieces. A crane lowers a steaming 4,500-pound electromagnet, and a sewer pipe weighing probably 3,000 pounds actually leaps a foot through the air to meet it. The operator deposits the pipe near three masked acetylene torchmen, who slice it

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up in a blinding dazzle of bluish fire. Nearby, another crane loads deafening avalanches of three-inch-thick steel girders into a 6-by-25-foot covered steel trough. The stuff clunks toward a mammoth contraption called a guillotine shear that looks scarily like the last thing Marie Antoinette must have seen. It pounds down every ten seconds with 1,100 tons of hydraulic force.

Ferrous foreman Mike Johnson took me over to the shredder. A clawed crane plucked a big sedan and set it on a conveyor that ended in a steeply dropping ramp. From the safety of a glassed-in control tower just above, we watched the car tip off and slide down. At the bottom, a toothed roller grabbed on and slowly fed the victim into a dark mouth while chomping up and down over collapsing bumper, hood and roof—a *Tyrannosaurus rex* for Toyotas. The car squealed, crunched and popped while steam and bits of glass whizzed out; then it was gone. Inside the belly, the final throes could be heard but not seen: fourteen 342-pound bell-shaped manganese-steel hammers swinging from a rotor whirling ten times a second at 3,000 horsepower. "Goes in the big hole, comes out the little hole," Johnson observed. After two weeks, the shredder's hammers are thrown into the scrap heap and replaced.

Once the stuff emerges from the shredder, a conveyor carries it to the double magnetic separation system (p. 37). Whirling magnets pick out ferrous chunks. Conveyors stream from underneath, bearing twisted bits. Unfortunately, not everything can be recycled—a growing challenge for the industry. One conveyor from the separator ends in a pile of "fluff"—mixed-up plastic, glass, rubber and other junk that goes to landfill—about 20 percent of the average car, and growing, as carmakers increase nonmetals and cut back on the steel. Most residue is not considered hazardous, but you have to be careful. The Denbos are spending close to $1 million paving parts of their yard to contain oil and other fluids to comply with rules set by the Environmental Protection Agency. If ozone-wrecking chlorofluorocarbons in old refrigerators are allowed to escape into the air, a fine of up to $25,000 a day may be imposed; the Denbos will no longer accept these appliances unless the CFCs have been professionally removed.

Pollution caused by others may hurt the worst. Many smelters that bought scrap over the decades have now ended as catastrophic Superfund sites because they badly handled the byproducts of remelting. Under a legal quirk, scrap processors can be held responsible as sources of "waste"—that is, the metal they sold—if smelters can't pay for cleanups. Attorneys for the scrap trade association, the Institute of Scrap Recycling Industries, say up to two-thirds of yards are embroiled in Superfund messes, and many could be destroyed. The Denbos may owe a quarter of a million dollars because they, among 900 others, sold lead batteries in the '70s to a smelter in Leeds, Alabama, who later spread slag everywhere, from a church parking lot to his own. The owner has since skipped the country, leaving a projected $58.8 million cleanup bill. "This is unjust. We followed the law. We sold a commodity, not a waste. We built a small empire and now it's jeopardized," said Morley with the only hint of bitterness I ever heard him utter.

The cost of environmental regulation is only one force that may pry businesses from family control. The Denbos are talking about an eddy current magnetic system to separate complex nonferrous metals: it will cost about $1 million. Guillotine shears cost more than $2 million; shredders, $4 million to $7 million. In the global metals trade, you can buy scrap one day only to see its value plummet the next. Last year's Sumitomo copper-trading scandal wrecked the price of copper and helped drag down the price of aluminum and other metals, squeezing dealers with big inventories. With profit margins often only 3 percent to 5 percent, the capital to ride out hits like this can often be mus-

Kevin Krajick, who writes from upstate New York, reports that he is now saving any scrap that comes his way, from brass latches to old aluminum gutters.

Novice Bronx scrapmen (top, from left), Rafael Garcia, Simon Alfonso, Edwin Arias, head out; at left, Edwin and Simon haul scrap; Edwin collects a cash payment.

tered only by diversified companies with deep pockets.

The Prolers got caught in the shifting complexities of the export business. After inventing the Prolerizer, they had become top players in scrap-steel export. But when the market for steel exports faltered, Proler International Corp. ended up owing $26 million for inventory it had bought. The Prolers had survived ups and downs for 72 years, but now the ante was too high. Last year, Schnitzer Steel Industries, a Portland-based scrap firm, bought them out. They are not alone. The 112-year-old David J. Joseph Company of Cincinnati is owned by SHV Holdings N.V. of the Netherlands. Schiavone-Bonomo, a 98-year-old New York/New Jersey outfit, is no longer run by anyone named Schiavone or Bonomo. A few days after the Proler buyout, I talked to Hymie Proler, 69, as he cleaned out his office. "I do feel sad," he said. "But it's in the best interest of the shareholders for us to sell."

After my visit in the South, I went back to Schoharie County, New York, where I had done my first copper trading. Stan Kivort, 60-year-old president of Kivort Steel, Inc., in the hamlet of Warnerville, echoed Proler. Bigger guys with shredders had cleaned out all the old cars from hedgerows around here, he told me. Worse, he said, "I used to have a guy who picked up from the plumbers. He was good for $300 or $400 a day in faucets and pipe. Now he's died and no one wants to do it. Nobody wants to deal with the *schmutz* [the dirt]."

Kivort's scrapman father came from Lithuania, near the Denbos' onetime home, but Stan has diversified. He still sells scrap to mills, but he also buys and sells new steel products including beams and rebar. One of his sons is a lawyer. Children of other scrap dealers have moved on as doctors, artists, oil entrepreneurs. "Little guys are passé," said Stan. "Peddlers are almost over."

In an effort to prove him wrong, I went 150 miles south to New York City, traditional gateway of enterprise. After some inquiries I found the glass-strewn corner of 207th Street and Ninth Avenue. A graffiti-like sign painted onto a garage wall read "SCRAP METAL."

Inside I found third-generation scrapman Paul Boritzer (guarded by a pit bull puppy named Lucky) buying small nonferrous items from local tradesmen and homeless people. His father runs a metals brokerage nearby.

Around 4 P.M., a maroon Econoline van about 87 percent on its way to being scrap itself rattled in, and two oil-streaked men in their twenties leaped out. Rafael Garcia and Edwin Arias, Dominican immigrants, roommates and best friends, told me they had quit their jobs

A Denbo supervisor, Bud Seay, maneuvers a forklift to cart away a well-secured bale of scrap aluminum.

six months ago to collect broken auto parts from garages for recycling. Where did they get this idea? "We saw other people doing it!" shouted Rafael with an ebullient smile. It was something they could get into without any capital. Their main expenses: gas, work gloves and clothes. "You can't clean them," he explained. "After one or two weeks we throw them away."

They showed me an invoice from a Bronx yard; today they had already gathered and unloaded 3,000 pounds of iron and steel. And now these guys were down on their knees on the pavement with hand sledges, smashing plastic parts off three brass car radiators so Boritzer would give them top price. They called themselves *junqueros.* Granddaddy Ike and Uncle Ben would have recognized them as fellow peddlers.

A few days later I met Edwin at 7:45 A.M. outside their Bronx apartment for a day's work. Rafael had to go make a deal for some wholesale blue jeans—a sideline perhaps akin to possum furs—so it was us, and a helper named Simon. At the first stop, National Auto Service on Jerome Avenue, Edwin jumped out and ran in. The manager had a couple of twisted iron pipes, which we grabbed and threw in back with a clang. Heading down to La Solución Auto Repair, we picked up an engine shaft and a few brake shoes. Another place yielded a 6-cylinder truck engine and transmission. "This is how we do it," said Edwin. "*Poco a poco.*" Little by little. Sometimes he paid $1 or $2, but usually people gave the stuff away.

"At first," he explained, "everything was just scrap metal to us. We sold it all together, same price. Then people say to us, 'Hey, why are you selling that for nothing?'" They discovered that zinc or brass radiators sold by the pound, not the ton. Remachinable brake shoes fetched 10 cents apiece; people who knew how to rebuild a starter might pay several dollars for one. "Every day you learn something different," said Edwin.

Late that morning, we got lucky—a garage going out of business. With the owner's permission, we began rummaging across the filthy floor and over shelves, dragging plastic trash barrels behind us. Grease-covered license plates, tire rims, carburetor parts and pulley wheels went in. Gears, nuts and bolts, ignition coils, a broken winch, a steering column, all lugged to the van.

After 20 stops, it was time to sell. Morillo & Ramirez Auto Electric gave $3 for a starter. Frankie's Auto coughed up a flat $5 for 49 brake shoes. A fixable transmission brought a whopping $10. Much of the rest was true scrap, good only for remelting. We stopped at Boulevard Smelting Corp. and sold a lead battery for $1.25. Other nonferrous items were put aside for delivery to Boritzer, whose shop is Edwin and Rafael's dream. "We could start our own with $20,000 for a scale and a garage," said Edwin. "Maybe five, seven years from now."

Finally we drove up to the truck scale at the entrance to Bronx Iron & Metals, a scrapyard run by the now noneponymous Schiavone-Bonomo Corporation. Beyond that lay cranes, torches, mud and mountains of metal—much like Denbo's. Except that instead of giant trucks bearing pieces of rockets or turbines, this place bustled with vehicles like Edwin and Rafael's—broken-down vans, pickups and converted tow trucks, loaded down with gleanings from Bronx streets and staffed by one or two fast-moving guys. All backed up, shoved deliveries onto the scrap heaps and headed out for more.

Our 6-cylinder truck engine was quickly pushed to the back of the van and tipped out the door. We heaved other objects out, then, with oil-saturated gloves, combed leftover bolts and gears down the length of the floor and out the tail. When we hit the scale on the way out, it showed us 1,820 pounds lighter. The man at the window handed Edwin $48.23. Total day's gross: $90.50.

Work was over. We drove to a tiny Dominican restaurant. After a few minutes of jokes and chat, a middle-aged woman turned on a water tap, and Edwin leaned his arms over the lunch counter into the stream. She squeezed a clump of green dish soap onto his upturned palms. He washed and washed. Simon did the same. After, they sat down and ate rice and beans and meat, and no one said a word for quite a while.

In the Denbo yard, jumbled engine blocks and cast-iron scrap take on the aspect of impromptu sculpture.

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By Jeff Wheelwright

Condors: back from the brink

Hopes for the endangered vultures' survival soared recently after six captive birds were released on a clifftop in the Arizona wilds

In the late 1950s, the writer Peter Matthiessen hiked into a remote canyon north of Los Angeles for a last look at the California condor. The huge vulture was sliding toward extinction. Depleted by wanton shooting and egg collecting, its population numbered fewer than 200 birds, and the birth rate—less than one chick per breeding pair per year—was failing to keep pace with mortalities. According to the fossil evidence, the condor once ranged over much of the continent, especially the West. Now its territory had shrunk to a U-shaped band of mountains in Southern California. Its habitat had been degraded by DDT, poisonous lead from the spent shot of hunters and the general reduction of open space.

Many biologists suspected that the great bird had been on earth so long that it might be a "senile" species. It had soared above saber-toothed cats and mastodons, and feasted on their carcasses, but it hadn't adapted to the changes in habitat and food supply that followed the end of the Ice Age.

Matthiessen waited for hours on a sunbaked mountaintop, searching the horizon. At last a pair of condors appeared in the west, heading toward him. He describes them in the final paragraph of his elegiac book, *Wildlife in America*: "They pass the ridge summit at eye level, implacably, and in that moment the naked orange of the head is bright. Then, as swiftly as they had come, they glide away, broad-backed as they sink across the canyon, alone in a world of gray-green brush, brown mountain, ocher cliffs, blue sky. The birds do not circle at the canyon but forge straight on, dark silhouettes against the pale plateaus in the far distance, as if, striking eastward on some ancient errand, they meant to return across the continent."

It is December 1996, forty years later, and condors have arrived at Vermillion Cliffs, Arizona, 400 miles from the California canyons. But they haven't quite completed their errand. The birds, six of them, are confined to a large wooden box at the top of the cliffs. At a signal from the U.S. Secretary of the Interior, who stands with 1,000 expectant people on the flat below the cliffs, the door will be opened and the condors will come out and reclaim part of their species' former territory. Condors have not been seen in Arizona since the 1920s. By the timescale of their existence, though, they have hardly been away.

This will be the eighth release of captive-bred California condors since 1992, and the first outside California. The population of wild and captive individuals at the end of 1996 stands at 120. Considering that the species at one point declined to a score of birds, this pullback from the brink is dazzling. The condor is not yet out of the woods, because the wild component is still small. However, with so many birds being produced, biologists can keep setting out fledglings until the new popula-

Photographs by Glenn Oakley

Schoolchildren (above, left) kept their eyes trained on the Vermillion Cliffs (top) where six young California condors bred in captivity were released last December. It was the first such release outside of California. After saying a blessing for the birds, a Navajo elder and his companions (above, right) rejoined the crowd.

tions take. A once moribund species is looking vigorous, thanks to the technology of captive breeding and at least 30 years of human dedication.

The morning sun makes slow headway against the cold desert air. In his remarks to the crowd, Secretary of the Interior Bruce Babbitt likens the condor-release project to the reintroduction of the wolf to Yellowstone National Park. It's another successful application of the Endangered Species Act, says Babbitt, and, as such, a fulfillment "of our obligation to protect and nourish God's creation."

The Endangered Species Act has been drawing a lot of fire lately, especially from Westerners, who see spotted owls, silverspot butterflies and other rare critters coming out of left field to block development and threaten jobs. The California condors have had to overcome much resistance here on the Arizona-Utah border. Since 1994, representatives of the U.S. Fish and Wildlife Service (USFWS), the agency overseeing the project, have been meeting with the small communities in the area. That Arizona is on board is indicated by the presence today of its governor and a U.S. senator. Utahans, though represented here, have been a tougher sell.

The release is taking place almost a year late, first because local governments asked for more time to assess the project, and subsequently because the federal government was late in signing off on it. In May of last year, San Juan County, in the southeast corner of Utah, actually sued to halt the program. Fundamentally, the Utahans were concerned that the far-ranging condors, alighting on private ranches or public grazing range, might interfere with their use of the land. What if a bird were hurt or killed? The biologists explained that these condors would be considered a "nonessential experimen-

tal" population. It is the least restrictive category for managing an endangered species. The USFWS agreed to honor individual requests to remove birds from any private or public property except national parks. No penalties would be assessed if a condor were harmed, unless the harm was intentional.

By the time the Utah lawsuit was dismissed last fall, the nine fledglings originally slated for the release were too old to go. The biologists don't want the condors to be able to fly well initially, lest they stray from their feeding sites. So the nine remain in captivity, while a younger six pioneer.

The USFWS hopes to establish a population in the region numbering 150 condors. The birds are not meant to commingle with the condors in California. The idea is to protect each group from a disease arising in the other by keeping them separated. Eventually, if both of the wild populations reach 150 and become "reproductively self-sustaining," steps may be taken to wean the condor from the safeguards of the Endangered Species Act. This would not be unprecedented. The bald eagle was downlisted last year from "endangered" to "threatened" after federal protection and a ban on DDT enabled it to bounce back. The peregrine falcon is poised to follow suit, thanks to a successful program of captive breeding and reintroduction.

Uncle Sam and conservation groups have spent millions on the condor in California and Arizona. The USFWS took the lead on the releases in California, but the Arizona project is being operated by a private organization, the Peregrine Fund. Located at the World Center for Birds of Prey, in Boise, Idaho (SMITHSONIAN, April 1990), the Peregrine Fund is largely responsible for the dramatic comeback of the peregrine falcon. Now it has begun to breed condors, joining the Los Angeles Zoo and the San Diego Wild Animal Park as caretakers of the captive population.

Six weeks before the Arizona release, a young bird bred in Boise and five reared in Los Angeles were helicoptered to the top of the Vermillion Cliffs. In shrouded cages, the condors were carried to the "hack box"—a structure 8 feet wide and 38 feet long, built about 75 feet from the edge of the cliff—and deposited in it. "The first two days, incredible noises came out of that box," recalls James Christian, one of the Peregrine Fund biologists. "The birds had to reestablish a pecking order. They hissed and warred with each other. They were hitting the plywood walls like little dinosaurs."

After the condors calmed down, they were let out into a connecting flight pen, which is larger and enclosed with chain-link fencing and mesh. There, spied upon by biologists in a nearby blind, the birds became acclimated to their surroundings: red rock, thin air, brisk wind, swish of pine, night temperatures in the teens, nine inches of snow at one point, ravens poking at the mesh, golden eagles coasting overhead. The House Rock Valley, tawny and bare, lies 1,000 feet straight below the condors' cliff, and on the far side of the valley are the muscular foothills of the Kaibab Plateau, mounting toward distant snow.

These 6-month-old condors are nearly full-grown. Their wingspan is about nine feet, but the birds weigh less than the adult average of 22 pounds. Heads and necks a juvenile gray, plumage a deep black, they hunker against the cold like puffed-up turkeys. Their flight pen is strewn with bones. The condors eat only carrion. They were started on laboratory rats and have graduated to stillborn calves, which have been donated by a dairy near Phoenix.

Occasionally one of the juveniles raises its wings and makes a dainty hop forward, like a lady lifting her skirts to cross a puddle. When the wind gusts, a condor springs into the air and hovers for a second or two. "I haven't seen that before," whispers Bill Heinrich, the Peregrine Fund release coordinator. "These birds are really ready to fly." Four of the fledglings cluster at the front of the pen and stick their heads into the wind.

Playing a "shell game" with eggs

On the morning of the release, the spectators peer through binoculars and tripod-mounted scopes toward the hack box, which even with help appears only as a smudge. It's more than a mile from the lip of the cliff to the throng waiting below. The people are kept that far away for a reason.

Condors raised for release are not supposed to associate anything that happens to them with human beings, unless it's something unpleasant. The established technique is to hatch eggs artificially and rear the chicks with a hand puppet resembling the head of an adult bird; the handler presents a food-filled beak from behind a barrier (SMITHSONIAN, December 1983). A new technique is to let a mated pair of condors do the job while a TV camera keeps close watch. The adults are not necessarily the parents of the chick they're feeding: a sort of "shell game" is played with the eggs. Condors normally lay just one egg, but if the first is removed, they will produce another; in captivity, condor pairs can produce three eggs in a breeding season. The first eggs are removed to incubators or to the empty nests of experienced parents. Ironically, there's more risk of injury to chicks from "parent"-rearing, but the contact may make the young birds better parents themselves when they

Jeff Wheelwright was formerly the science editor for Life *magazine. He last wrote for* SMITHSONIAN *about methyl bromide, in the December 1996 issue.*

breed in the wild and has the added benefit of reducing their links with humans.

The six juveniles at Vermillion Cliffs are only the second group of parent-reared California condors to be let go. The night before the release, the biologists forced them back inside the hack box, and then quietly dismantled the flight pen. Now it's almost time. Robert Mesta, the USFWS coordinator for the program, introduces to the crowd a Navajo elder who is going to say a blessing. "This is not a performance," Mesta says. "It is a prayer to welcome a brother back. I ask that you take no pictures." The ponytailed Mesta is Native American himself. The television crews shut down and the schoolchildren, larking for the morning, are hushed.

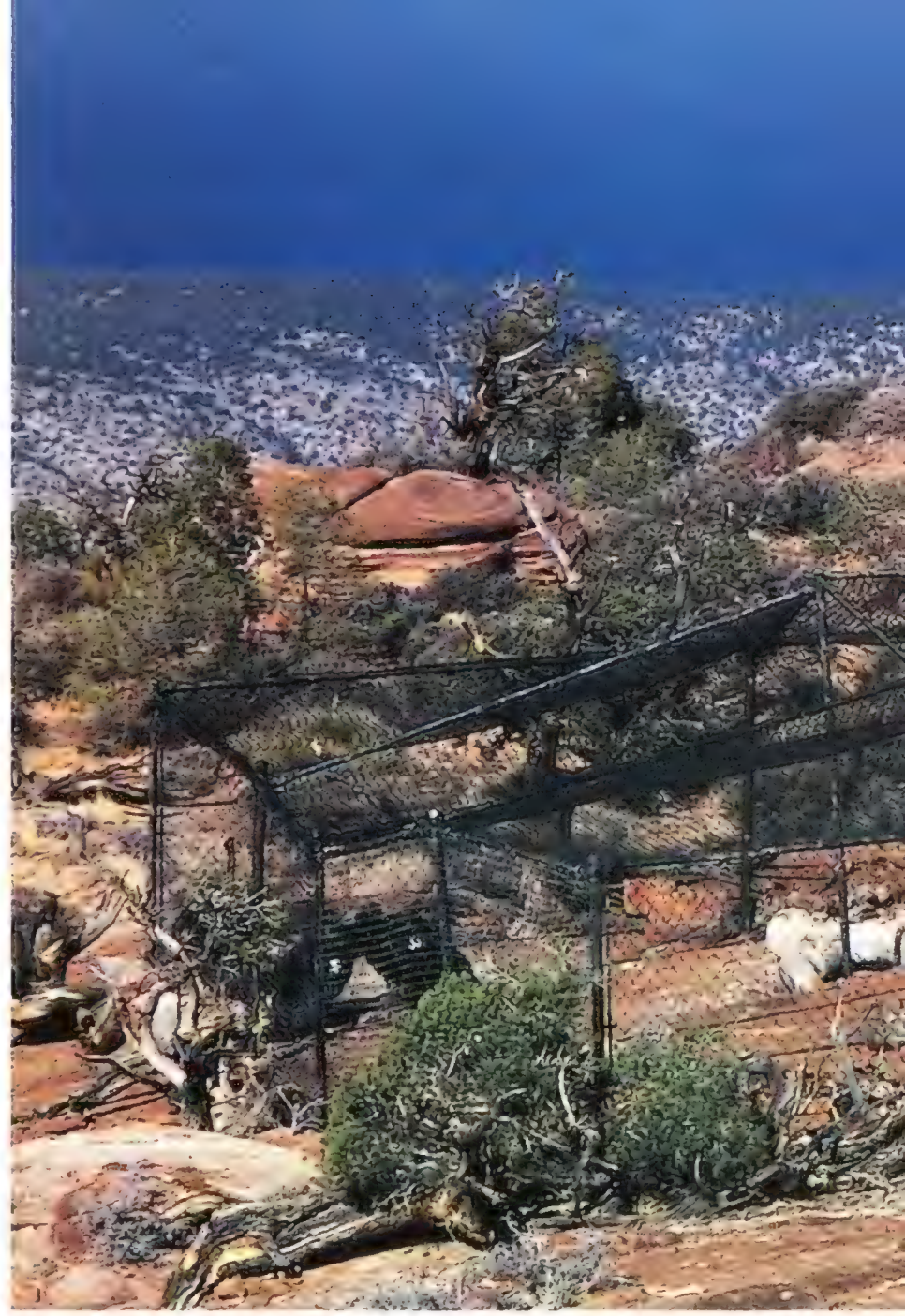
The old man and five young Navajos kneel before the cliffs; wisps of their chants float upon the breeze. Their obeisance underscores what everyone has been feeling: that the spirit of the event is embodied not so much in the six fledglings, born in captivity, but in the awesome presence of the Vermillion Cliffs themselves.

Thermal currents above fiery cliffs

John Wesley Powell, the explorer who named the cliffs, no doubt realized that "vermillion" was a lame adjective for their molten hues. In the low afternoon sun, shadows of cloud drift across the sheer walls and constantly rework their color and texture. Burnt brick abruptly ignites, becomes coralline, infuses with blood, wanes toward magenta. This formation runs for 30 miles in a leisurely arc from northeast to south to northwest. Atop the cliffs is the Paria Plateau, bearing a forest of piñon and juniper. The whole area is wilderness, pretty much, though grazed top and bottom by cattle. Cattle aren't a bad thing for condors, of course, nor are deer, which are plentiful up on the Kaibab these days, having rebounded from a disastrous low in the recent past. The prevailing winds blow onto the cliffs, causing updrafts that the birds will use to reach the high thermal currents. Half a mile up, they will soar for hours on end. Eventually, with their sharp eyes, they should be able to forage for carrion occurring naturally on the ground, but dead calves and other carcasses will be provided as long as they need them.

It used to be a big issue in conservation circles whether the condor should live free or be allowed to become, in the disparaging words of environmentalist David Brower, "a managed facsimile of the original." Should the finicky species have been left alone to die with dignity if its habitat couldn't be preserved? Or should scientists capture the remaining birds, tinker with them and send out the next generation with life support?

The debate is finished today. Lloyd Kiff, science director of the Peregrine Fund, a veteran of those arguments and a leader of the condor rescue effort since the '80s, is



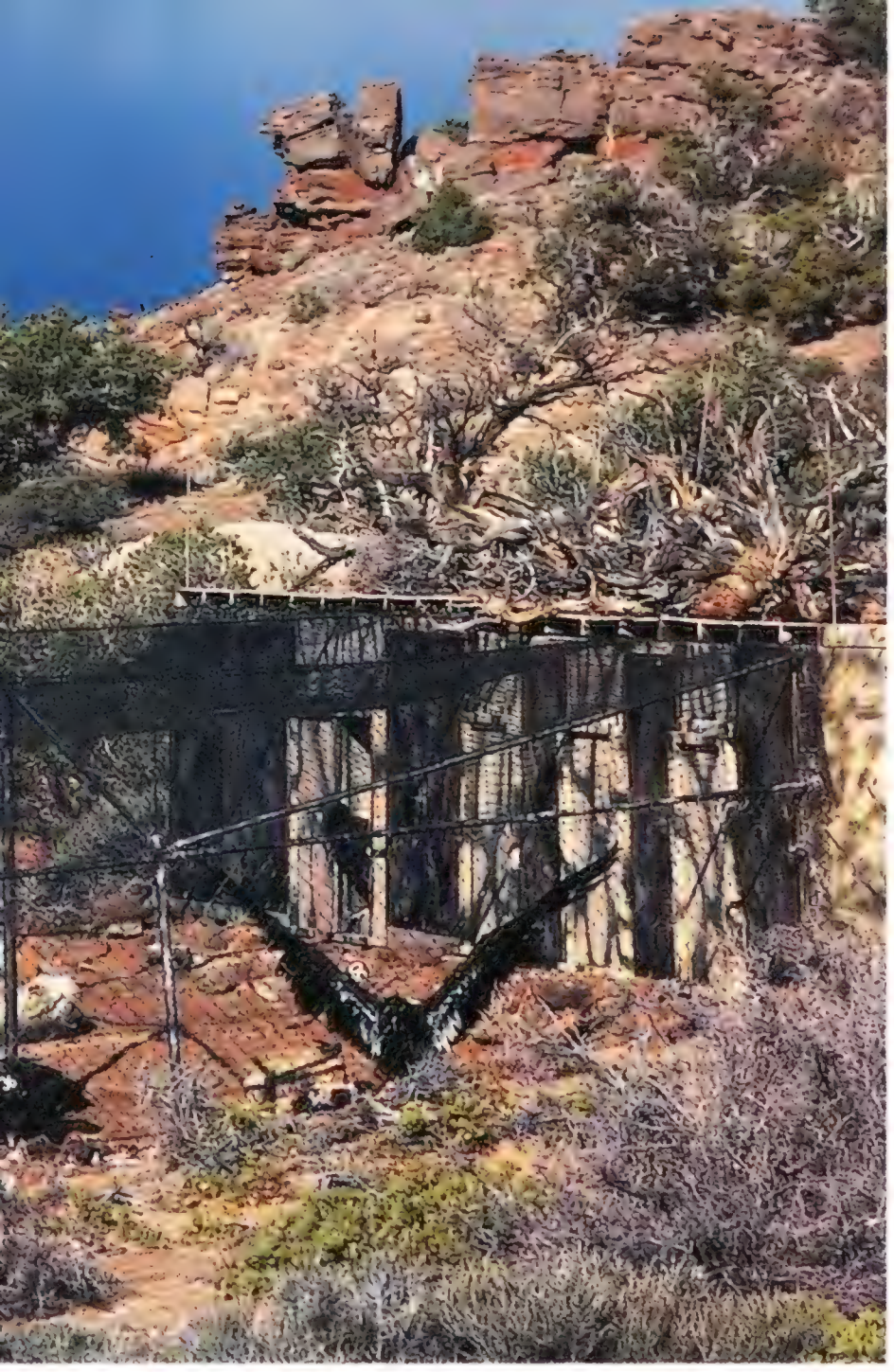
Before they were let go, the six juveniles got used to their new surroundings in a large, open-air flight pen.

the last speaker to take the platform. Not sentimental, or maybe hiding it, he says, "I'd like Secretary Babbitt to help kick these things off the cliff."

Babbitt begins counting down into the microphone: "Ten . . . nine . . . eight . . ." On the roof of the hack box, a biologist yanks up the door, then scrambles out of sight. There is an anticlimactic pause. A black spot comes forward. The bird spreads its wings . . . and folds them, like a Hawaiian cliff diver who thinks better of it.

Now all six birds are out of the box. The Boise bird, a female whose official number is 150, launches and makes a low, gimpy flight along the rim to the south. Two more birds follow; they come to roost 200 yards away from the box. Loud cheers and clapping from below, and the journalists bolt for the satellite trucks. By afternoon, the House Rock Valley is empty of visitors save for the team of young biologists who will monitor the birds for the Peregrine Fund.

It's easy to anthropomorphize condors because they are social animals that behave with a goofy individuality.



The pen was about 75 feet from the edge of the cliff. Monitors watched the birds from two blinds nearby.

In this flock of six, bird number 142 stands out. "He's weird," monitor James Christian says a few weeks after the release. "He doesn't roost with the others."

Earlier, 142 had flapped off the cliffs and flown across the valley to the Kaibab foothills. Each bird can be located by the signals from the two transmitters it wears. Moreover its wings are tagged with its number. When coyotes began to stalk 142, the staff decided to grab him and put him back on top with the others. He tried to scuttle away but was soon caught. Yesterday a calf carcass slipped off the rim, falling 100 feet to a ledge. The "weird" condor found it quickly. "Forty-two really has come around," maintains Hannah Ogden, a third member of the monitoring team. (The biologists drop the "hundred" when referring to the birds.)

The biologists have discovered that the hack site is located between the territories of two pairs of golden eagles. Sometimes an eagle will buzz the condors during their short forays aloft; more regularly the goldens come down to the carcasses that have been put out for the condors. Bald eagles drop by, too, and the ubiquitous ravens. For the most part, the condors keep their distance, but once, approaching submissively, a young condor was able to take food out of a golden's mouth.

All day on the flat, the biologists watch in fascination. If the weather is nice, they employ their spotting scopes while sitting in lawn chairs. Flights are what they hope for. Morning sun on the cliffs gets the air rising and also energizes the birds, which hold out their wings as solar collectors. Soon a condor takes off, and another, three now tacking across the desert sky on stiff black sails. There is no mistaking them for turkey vultures, which are small and tippy by comparison.

"Thirty-three's up!"

"Did 49 go?"

"No, he's still to the right of the high carcass."

"Fifty-one just did that stretch you like."

"Cool."

At night, the observers e-mail their field notes to the Peregrine Fund office in Boise, for posting on the organization's Website. Here is the report for January 10, 1997, by Mark Vekasy, another Peregrine Fund monitor:

"This was Condor 33's first feeding in 11 days. Although this is a long duration between feedings, she showed no visible signs of distress, and was flying as well as the other birds. The absence of activity from Condor 42 was worrisome, so we hiked in towards the Cove to obtain a visual. As we neared the cliff base, it became evident from the signal direction that the bird was on the ground. We found Condor 42's body approximately 150 meters from the cliff among some small shrubs. All clues in the area indicated that Condor 42 had probably been forced from the air by an eagle and fought on the ground. It appeared that a puncture wound to the head was the worst injury."

The news of 42's death spreads through the project. Having taken charge of the condor population in loco parentis, as it were, the biologists feel responsible when something goes wrong, and they review their own actions anxiously. In this case, they decide the loss is not their fault. Forty-two was too independent for his own good, a "renegade," according to Robert Mesta. The bird's lack of support from an adult flock made him vulnerable, says Lloyd Kiff. "He was selected against, you could say," says Bill Heinrich, taking the Darwinian view that 42 was somehow less fit for survival.

Michael Wallace, who is curator of conservation at the Los Angeles Zoo, rejects the notion that 42 was "weird." Forty-two was Wallace's baby, so to speak. "I don't recall anything unusual about his rearing. In groups of condors there is often one bird that becomes a loner for a while. They usually grow out of it. But in the meantime," he concedes, "it does put them at risk."

Wallace currently oversees about 50 condors in outdoor aviaries (known as "condorminiums") that are off-

A bald eagle, at left, helped itself to a carcass that biologists set out to feed the newly liberated condors.

limits to the public. One of his breeding pairs, a male named AC-9 and a female, Squapuni, produced two of the birds that were released at Vermillion Cliffs. AC-9 was the last truly wild California condor to be netted and brought into captivity. The year was 1987, and his capture left California's coastal mountains bereft of condors while Wallace and others on the recovery team perfected their breeding techniques.

The parents of the ill-starred 42 are called Cuyama and Cachuma. They were taken from the wild as chicks in 1983, and like the zoo's other breeding pairs, they have a flight pen all to themselves. It is 100 feet long, built on a slope and flanked by the pens of other condors. There is a nest box on the high ground of the pen and an elevated blind at the other end.

In Los Angeles, the conditions for bird-watching are better than on the wintry Paria Plateau. The blind here has a comfortable chair and curtained windows, and if the birds retreat to the nest box, they can be followed on a TV monitor. Wallace says that Cuyama and Cachuma, after many years together, are experienced breeders and hardly bother with courtship during the mating season, which runs from January to April. Today they are sunning, or bathing singly in the wading pool. Except for a brief display by the male Cuyama, who hops about Cachuma like a matador with two capes, they keep away from each other.

What is striking about an adult condor is the regal pink-and-orange coloring of the naked head and neck (pp. 48-49). Pink is the color of agitation or sexual excitement. The skin also may contain hints of yellow or light blue; the tones are changeable, like those washing the Vermillion Cliffs. Equally striking is the condor's size—with a wingspan of nine feet and a body four feet in length. A mature condor's neck is long and serpentine, able to extend the bill deep into the cavities of carcasses. When the bird is perched, with wings folded, its enormity is somewhat disguised. But the illusion evaporates as Cuyama takes off toward the blind. His wings, their white underparts flashing, beat the air with a deep *whoomp-whoomp*, and he hits the perch with a rattling bang.

Wallace and his colleagues are interested in a couple of new ideas. In addition to parent-rearing as an alternative to puppet-rearing, they are experimenting with aversive conditioning: what you might call "tough love." When wing tags have to be applied to a group of young condors, or blood samples taken, first a man will stand in plain view 200 feet from their pen. After the condors notice the strange creature, other people rush through a side door to seize the birds. This rough treatment is administered three or four times during a condor's upbringing. It is hoped that when birds get out into the real world, a distant sighting of a human will trigger a strong desire to flee. The reason for such conditioning is that condors released in California have been drawn to populated areas and, as a result, to perches on power-line and telephone poles. The behavior, part youthful curiosity, part ignorance, has been fatal more than once, with birds flying into lines and being killed by the impact or by electrocution. Therefore in some of the pens at the zoo, electrified telephone poles have been placed among more natural perches. The "hotfoots" teach the birds to avoid the man-made structures.

"We have to design a bird that's going to settle in and survive," Wallace says. His language would make David Brower cringe. "These harassments, as we sometimes call them—they make some biologists uncomfortable. But we hope to see model condor citizens out there." Model condor citizens, of course, prefer their own kind to people.

As spring approaches on the Vermillion Cliffs, the condors shift their nighttime roost a bit to the south, responding to the changing position of the sun. Flights lasting three hours at altitudes up to 1,000 feet above the rim have been observed. Golden eagles soar and interact with the condors "without any serious consequences," writes Mark Vekasy. When new food is placed a mile from the hack site, the birds are able to find it.

The long-range plan is to guide the condors to an even wilder home. As the flock is increased in number, the birds will be lured by the placement of carcasses first to the west and then south toward the Grand Canyon, 30 miles distant. The Grand Canyon has caves containing the bones of Ice Age condors. Since it is a 1,904-square-mile national park, the place should be safe for the birds, and in five or six years, when they are reproductively mature, they ought to be able to nest in the high caves themselves.

Once or twice a week, the monitors go up on the Paria Plateau with fresh carcasses. On this evening, James Christian and fellow biologist Shawn Farry take the truck just after sunset. The dirt road twists through sagebrush and squat conifers, through patches of new snow and pockets of red sand. In the Mesozoic era, dunes were here instead of cliffs. Two black-and-white calves lie in the back as if they were sleeping.

Wildlife biology can be a dirty job, but someone's got to do it. Farry cuts the bodies open, making it easier for the condors to feed. After loading the carcasses onto a sled, James Christian shouts, "Calf luge!" and runs downhill through the snow, pulling the sled behind him.

The sled can't pass over the rubbly ledges near the cliff edge, so each man takes hold of a foreleg and they stumble forward with a carcass. Dropping their voices to a whisper, they lash the first calf to a log with wire. By now it is dark. Orion appears, floating in the sky at eye level, and then the constellation recedes as more and more stars appear around it.

Raw starlight and snow help illuminate their footing as Christian and Farry haul away the second carcass. A hoodoo looms above them, a statue of stone in silhouette. The men must know where they're going, but they seem to have stepped off into the thin air above the House Rock Valley.

All is quiet. The birds are roosting a hundred feet below. In spite of their conditioning, don't they sense that well-meaning humans are involved in their accommodation to the Vermillion Cliffs? Are they perhaps like youngsters on Christmas Eve, pretending not to hear as "Santa" fills their stockings downstairs? Far to the south, lightning flickers above the Grand Canyon, the future fortress of the condors.

Soon after its release, a seemingly exultant bird tested its outstretched wings. Scientists are hopeful that condor reintroductions in Arizona and California have launched the species on a safe flight to recovery.

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By Henry Adams

A heartland artist who broke the old regionalist mold

Two current exhibitions prove that, although Charles Burchfield's watercolors are set in specific places, these works know no boundaries

Does the metropolis hold a monopoly on the history of American art? Every artist grew up someplace, in many cases far from New York, San Francisco or the cities in between. Yet, in the 20th century, those who stayed close to home have often been misunderstood, pegged too narrowly as "regionalist" or simply ignored as irrelevant by critics with their eyes turned toward European modernism. Enter—or should I say, reenter—Charles Ephraim Burchfield.

The curious thing about Burchfield's watercolors is that, for all their evocation of the miraculous and transcendent, they consistently convey a strong sense of specific place. His responses to his surroundings, from the moods and sounds of nature to the simple houses in his neighborhood, were imbued with a deep personal symbolism. Burchfield had no great desire to travel. He preferred to live and work in the Midwest and the eastern Great Lakes region—first, Salem, Ohio, and later, Buffalo, New York, and its suburb Gardenville.

When I made a pilgrimage to Salem to absorb the world of his paintings, my first step was to rendezvous with Richard Wootten. Wootten, who served for many years as art editor for *The Cleveland Press*, moved to Salem 15 years ago. At first, after the rushed pace of Cleveland, the quietness of Salem nearly drove him

One can almost taste the snowflakes in *Main Street, Salem—Winter Day*, a 1917 painting reworked in 1943.

Private collection

crazy. He felt he had ended up in noplace, where nothing significant ever happened.

But as Wootten settled into taking things more slowly, he was increasingly drawn into one aspect of Salem's history: from 1898 to 1921, this small town had been the home of artist Charles Burchfield. Here, Burchfield grew up and, at age 24, experienced what he would later call his "golden year," 1917, during which he produced watercolors at a rate of two or three a week in an explosion of talent.

Salem has changed little since 1917; its population has grown slightly, and there has been some new development, but most of the buildings Burchfield painted still stand. For Wootten, the whole town felt like a Burchfield museum, and he began identifying the buildings and other motifs found in the artist's paintings.

Now, Wootten's research is being featured, beside that of a half-dozen other writers and scholars, in the largest show of Burchfield's work in more than a decade. Consisting of 147 works, "The Paintings of Charles Burchfield: North by Midwest," curated by Nannette Maciejunes and Michael Hall, and organized by the Columbus Museum of Art, has just begun a national tour (specific works on view at each stop will vary). After closing in Columbus on May 18, it will travel to the Burchfield-Penney Art Center in Buffalo, New York (June 15-August 17, 1997), and the Smithsonian's National Museum of American Art (September 26, 1997-January 25, 1998). The show is sponsored by the Charles E. Burchfield Foundation and Ameritech.

Concurrently, a second Burchfield exhibition, curated by Nancy Weekly and drawn from the collection of the Burchfield-Penney Art Center (which holds the largest collection of Burchfield's work), will also go on national tour. Circulated by the American Federation of Arts, this 66-work show opens at the Everson Museum in Syracuse, New York (May 16-August 17), and will then travel to five other museums around the country. The exhibition's catalog provides a detailed look at the museum's Burchfield holdings from all phases of the artist's career.

Visitors to these exhibitions are likely to be surprised by Burchfield's intriguing paintings. Long recognized as a major American master, he has nonetheless slipped from view, playing a smaller and smaller role in surveys of American art. The catalog of the Columbus show, published by Harry N. Abrams, seeks to change this by presenting a range of unusual perspectives to Burchfield's work—from semiological to psychological. Amid this academic company, Wootten's brief piece on "Burchfield's Places" seems straightforward. But in fact it addresses a major theme of the exhibition: How did such a remarkable body of work emerge from such an unassuming man in seemingly quite ordinary settings?

In Salem, Burchfield's most familiar place was the small house where he grew up; it stands on the northeast edge of town. In the artist's time it was separated from open fields by a single block of houses. Burchfield's mother, Alice, moved here from Ashtabula with her six children after her husband died, leaving her without support. Her two brothers pooled their funds to buy her the house. Burchfield's oldest brother, Jim, worked as a coremaker's assistant to support the struggling family. During high school, Burchfield worked at the drugstore

Author Henry Adams last wrote for SMITHSONIAN *on Rembrandt in December 1995. His most recent publication is* Dale Chihuly: Thirty Years in Glass.

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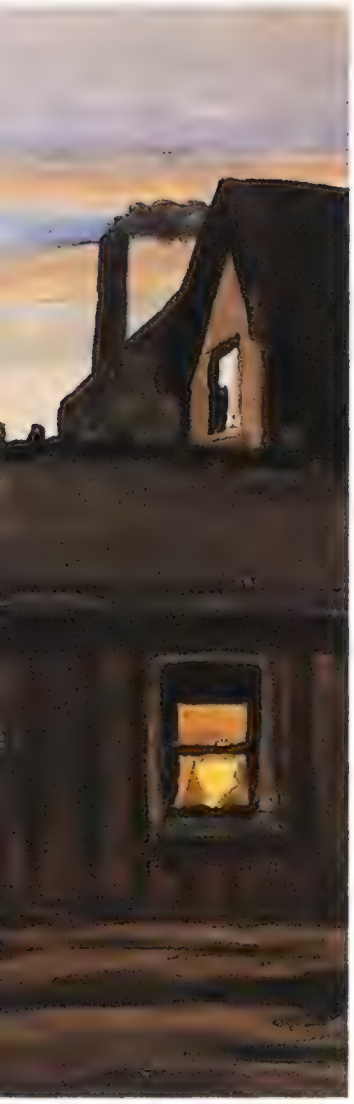

San Diego Museum of Art

The Weaver house in Salem, Ohio, with its low profile and tall chimney (below, center), can be discerned in the highly symbolic *The Night Wind*, 1918 (below, left), and in *House in November Evening*, 1919 (above, left). In *Rainy Night*, 1930 (above), a woman gets into a taxi on the corner of Broadway and Ellicott Street in Buffalo, New York (below).

and in the mailing department of the Mullins Company, a metal-fabricating firm.

Today the house is owned by the Burchfield Homestead Society, which is raising funds to restore it. In spite of its water-stained walls, holes in the floor and peeling linoleum, it echoes Burchfield's paintings throughout, bringing to mind an image of his mother sitting in the parlor, or his upstairs bedroom at night, or the sunflowers in the backyard.

Flowers, and indeed all of nature, were key in first motivating young Charles toward painting. A shy and somewhat lonely youngster, he spent long hours exploring the nearby woods with his pug, Roger. When he discovered the writings of John Burroughs, he decided that he wanted to become a nature writer and illustrator. In his early teens he began making meticulous drawings of flowers and trees. Toward the end of high school he also started writing in a journal, which he kept up regularly for the next 50 years (by the time he died in 1967, it filled 72 volumes).

Burchfield's goal of becoming an illustrator led him to enroll in the Cleveland School of Art, where he studied for four years. There, his small, close-knit group of friends couldn't replace his hankering for nature. A year after arriving, he wrote in his journal, "It is with some regret that I look over my last few entries before

coming to Cleveland. In them I see an ever-growing ease in describing nature which—all at once—has been nipped by my coming to Cleveland." The soul-searching nature evident in this journal entry is apparent in Burchfield's only known watercolor self-portrait (p. 68). He did it during his final term of art school, in 1916.

After graduating later that year, Burchfield went to New York City, where he had received a scholarship to the National Academy of Design. But he was miserable there; within two months, he returned to Salem where, except for a brief stint in the Army, he lived with his mother for the next five years.

Burchfield's return to Salem in late November 1916 proved a turning point in his life. "Arrived at Salem about 5:30 A.M. after an all-night ride on the train," he wrote in his journal. "Feeling seedy, grimy and hungry—and in very low spirits; feeling that my trip to New York was a complete failure. But the welcome I got from the family made up for everything."

The next day, he got his old job back at Mullins. "I had two days before I started to work," he later wrote, "and although it was snowing I went sketching out into the country. One of the supremely happy moments of my whole life was when I stood in the woods and listened to the wind soaring in the tree-tops. After the days of agony in New York, it seemed to me the most wonderful music I ever heard. The result of that day's walk was six watercolors, done in the evenings of the following week."

Working at Mullins five days a week and Saturday mornings, Burchfield put himself on a tight schedule so that he could paint. Rushing home on his lunch break, he would gulp down his food, leaving enough time to make a quick pencil sketch before hurrying back to the office. In the evenings, he finished the works. In 12 months, he produced roughly 200 watercolors, averaging one every couple of days.

Remembering Burchfield, one elderly woman said to Wootten, "he walked in alleys." It's one of those telling remarks. Burchfield never painted Salem's row of fine Victorian mansions; instead, he focused on the route that led from his mother's house to the Mullins Company, which he walked to work each day. Years later, Burchfield drew a map of this path for his biographer, John Baur—from Fourth Street southward on Vine, west on Main (now called State Street) past a row of commercial buildings, south on Penn, southwest across a lot to Lundy, south on Lundy, then down Foundry Hill to Hogan's Alley and on to the factory.

Wandering in the environs of this route today, as I did with Dick Wootten, one can find dozens of motifs that Burchfield drew and painted. *Three Days' Rain* (1918) shows a flower shop at the corner of State and Penn; *February Thaw* (1920) most likely depicts Jerry's Barbershop at Ellsworth Avenue and State Street; *Twilight in the Alley* (1920) features a stairway on the east side of Lean's Bakery and Deli. These and many more of his motifs are still there, though they may be difficult at first to spot due to a change in awning or fence, architectural detail, or paint color.

Some of them may also be difficult to recognize because, far from being literal transcriptions, they were transformed by Burchfield's feverish imagination. He saw faces in houses, often visualizing them as portraits of the people who lived in them. "A house is often more moody than nature," he wrote in his journal in 1916. "In the daytime they have an astonished look; at dusk they are evil; seem to brood over some crime. . . . Each one is an individual." In fact, Burchfield's paintings represent a curious synthesis of realistic representation with more abstract conventions for evoking sounds and feelings.

In 1917, Burchfield sketched a series of semiabstract symbols for expressing emotions, representing such concepts as "fear" (a hooked spiral), "imbecility" (blank staring eyes), "morbidness" (a peaked form) and "fascination of evil" (a smirking mouth). In works such as *Church Bells Ringing, Rainy Day*, from that year, and *The*

Burchfield-Penney Art Center

Burchfield's intense response to nature is apparent in his 1918 watercolor *Untitled (Gothic Window Trees)*.

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Private collection

In 1935, Burchfield stood ankle-deep in mud to paint *Black Iron*, a double railroad bridge in Buffalo. The painting typifies his works from the 1930s—sublime images of industrial sites, in dark washes of color.

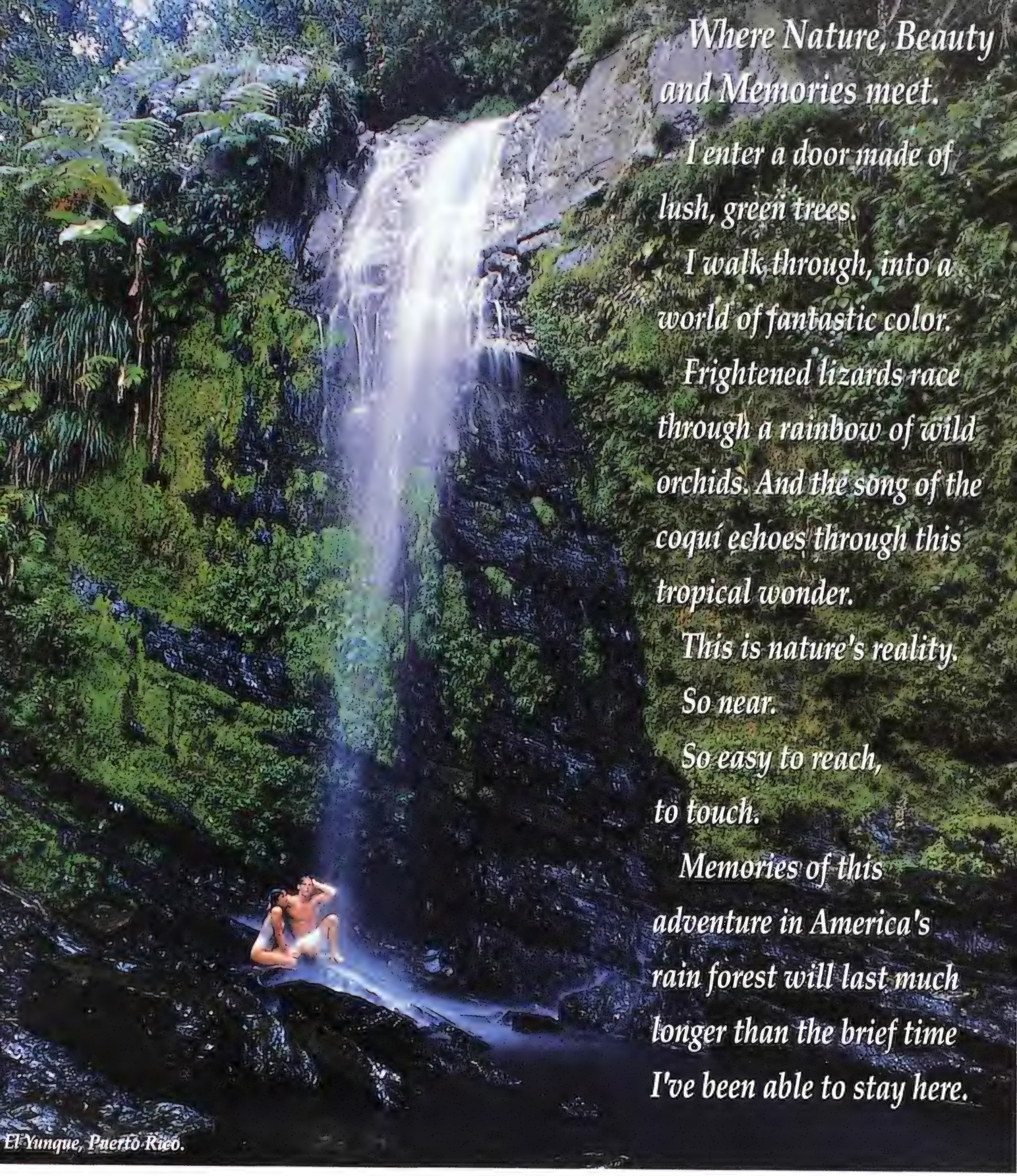
Night Wind of 1918 (p. 60), Burchfield employed his new symbolic vocabulary.

Church Bells Ringing, Rainy Day was inspired by a Baptist church near his home that had an unusual Gothic tower. As a child he had lain in bed listening to the bells with a mixture of fascination and fear, and he wanted to convey that feeling in visual form. He rendered the bell of the church as a hooked spiral of fear, and repeated that same spiral in the sky, elongating it to suggest the reverberations of the tone. In similar fashion, he altered the windows of the steeple, the forms of neighboring houses and other elements of the composition.

In *The Night Wind,* the hooked spiral of fear becomes the wind itself, while the staring eyes of imbecility become the mask of night. But this painting is not purely abstract; the house represented here is the Weaver house—the long, low house next door, which Burchfield could see from his bedroom window. The year after he painted *The Night Wind,* Burchfield painted *House in November Evening*—it's the same house, but a far more literal interpretation.

Burchfield's Salem period came to an end in 1921 when, at age 28, he moved to Buffalo, New York, to take a job designing wallpaper for M. H. Birge and Sons. He had just become engaged to Bertha Kenreich, who lived on a nearby farm, and he had to earn a serious income to support them both. When Charles first met Bertha, he was wearing a pair of "half-moon" glasses; she later confessed that she had thought he looked weird. They were a devoted couple, and like his mother, she was completely supportive of him. Despite the hardships of the Depression, they raised four girls and a boy in a household filled with good cheer. Meanwhile, his early paintings lay in a drawer.

For eight years, as Burchfield developed designs for wallpapers and supervised their production, he produced little of his own art. Given his name, it is striking that his first effort depicted a field of birches (p. 66); he later remembered it as "about my favorite." His designs, which are no longer in production, possess a haunting, restless beauty. Burchfield finally broke with the Birge company in 1929 after talking with Frank Rehn, a New York art dealer eager to represent him. The time could hardly have been more inauspicious; the stock-market crash occurred only a few months later. But although finances were often tight, the family was able to make ends meet. Burchfield's career was greatly helped when Alfred Barr, director of the Museum of Modern Art, or-



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ganized a one-man show in 1930, describing Burchfield as "one of the most isolated and original phenomena in American art." This exhibition established him nationally as a modernist and visionary.

During these years, Burchfield's work became larger, grander and more realistic. His watercolors had to compete for wall space against oil paintings, which were generally more highly regarded. And, no doubt he hoped that larger paintings would seem more impressive, bringing higher prices. The shift paralleled a general change in American art, from the exuberant mood of the 1920s, which favored abstraction and experimentation, to the grimmer, starker mood of the 1930s, when artists tended to focus on the American scene.

Burchfield was particularly attracted to the most industrial part of the city, down by the Buffalo River. Like his Salem watercolors, the works of this period often convey the feeling of an outsider looking in. I sought one motif in particular, the railroad bridge that inspired Burchfield's painting *Black Iron* (p. 64), a watercolor so compelling that his Buffalo years have sometimes been termed "The Black Iron Period." I found a bridge that is identical to the one he painted.

To get to it, I drove past the towering grain elevators that line the black, oily Buffalo River, past a pair of railroad drawbridges, through a dump, down a dirt road edged by piles of dirt and slag and into a section of thick undergrowth. There, rather suddenly, I came upon the impressive structure.

Burchfield showed the bridge with a train rushing across it, blowing a white puff of steam. Today the tracks are no longer used, and the area is overgrown with shrubbery, making it impossible to get to his vantage point. The bridge is a little frightening in its enormous scale. A 19th-century viewer would have described it as "sublime"; its scale and desolate setting are at once heroic and terrifying.

Black Iron is seemingly so literal, so exact, that it can take a while to notice how Burchfield subtly altered the scene. His vigorous brushwork, however, endows the powerful V-shapes created by the concrete counterweights with a gestural force, and also creates subtle rhythms between the different forms, linking sky, water, earth and rusting iron in a harmonious visual unity.

Burchfield-Penney Art Center

Burchfield's first wallpaper design, after taking a job —which he hated—in Buffalo, was *The Birches* (1921).

"Hopper on a rainy day"

Other Buffalo sites that Burchfield sought out are less imposing in reality than in the paintings. One of his greatest watercolors, *Rainy Night* (p. 61), portrays a group of gloomy turn-of-the-century structures on the corner of Broadway and Ellicott Street. In the foreground a woman gets into a taxicab; across the street, in front of a row of commercial buildings, a man stops on the sidewalk to look into one of the windows. The piece evokes a time when downtown was a bustling place, not yet replaced by suburban shopping malls. Yet at night, in the rain, the place has a lonely quality, suggestive of the desolation to come. Perhaps only Edward Hopper has managed to coax so much mood from simple things—a feeling at once wistful and poetic. Indeed, Burchfield's works from this period have sometimes been described as "Hopper on a rainy day."

Because of the angle Burchfield took in *Rainy Night*, the buildings appear grand and important. Going to the site itself, I was surprised by how ordinary they looked—just a line of decaying structures stretching along Broadway. Had someone not told me where to go, I would have walked by the corner building, the key structure in his painting, without turning my head. When studied closely, however, Burchfield's motif is quite distinctive in its powerful massing, and in the flair of its tall windows, gloomy gables and tall mansard.

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Burchfield-Penney Art Center

Burchfield's only watercolor self-portrait, painted at age 23, is featured in the Burchfield-Penney show.

In *Rainy Night* and many of his other works, Burchfield used watercolor in an unusual way. Watercolor was traditionally considered most suitable for sunny effects, achieved by painting thinly and leaving lots of white paper untouched, so that the colors glow.

Burchfield liked to use drab earth colors, dulling the glow of his pigments with successive layers of brown and gray. Few oil paintings convey the sense of heaviness, of the downward pull of gravity, that Burchfield achieved in this supposedly delicate medium.

There are other idiosyncrasies in the way Burchfield worked. While most watercolorists work on sheets of standard-size paper, he often added strips of paper on the sides to expand his compositions. Apparently, he picked up this habit in designing wallpaper. The effect was often a dramatic opening up of his compositions. And, while watercolor is usually considered a spontaneous medium, Burchfield often worked on his watercolors for years, adding one wash on top of another, and painstakingly scraping and repainting to get the effect he wanted. These techniques, which created colors that were darker, less ethereal and more substantial, were particularly apt for the industrial scenes of Buffalo, a frequent motif in his paintings from about 1929 to 1941.

With the coming of the war, Burchfield's access to Buffalo's industrial sites was cut off. Since 1925, the family had lived in a modest house in Gardenville, directly east of Buffalo. In the deep back lot were a garden and a small studio. Burchfield created dozens of memorable paintings out of the simplest of elements—a shed, a few trees, a bit of fence, the side of a house. All convey a strong sense of the season—the cold of winter, the melting snow of early spring, the white heat of the sky on a hot summer day, the windiness of autumn. "I don't believe there are many more banal and flat places than this village," Burchfield wrote to Edward Root, a professor of art who collected his work, "and yet somehow after you live in a place for a certain length of time, things and places begin to belong to you."

Increasingly, Burchfield also reached into the landscape of his mind for motifs, as Salem reappeared in his art. In 1943, at the age of 50, he even began enlarging unfinished early paintings from the Salem period. *Main Street, Salem—Winter Day* (p. 58) is such a work; the seams where he added paper are visible in the center portion of the painting. His original vision of Main Street is expanded by the tall building at the right, which bears his own birth date, 1893. Heavy paint strokes delineating a heavy snowfall unite the composition into a magical image that is simultaneously dreamlike and immediate.

As Burchfield's works became increasingly layered and fantastic, some of them, such as *The Sphinx and the Milky Way* of 1946 (opposite), came close to completely losing the image. But at the right-hand side we can discern a familiar motif from Salem, the Weaver house, identifiable by its long, low silhouette and tall chimney.

In 1960, as he had done many times before, Charles Burchfield took out one of his many old watercolors of the Weaver house. "Once again I am making extensive alterations in the picture simplifying and increasing the sense of the magic and mystery of the universe," he wrote in his journal. "Our winter now is almost identical to the 1917 winter."

Burchfield's struggle to express his intense response to nature with his personal symbolic vocabulary continued until his death in 1967. He had raised a family, achieved a measure of recognition (membership in the National Academy of Design; numerous prizes and honors), and lived an upstanding life. Yet in the end, it was as though he looped back upon himself, as images of his early years floated at the surface of his consciousness.

The Sphinx and the Milky Way, from 1946; the Weaver house, lower right, enters the realm of the fantastic.

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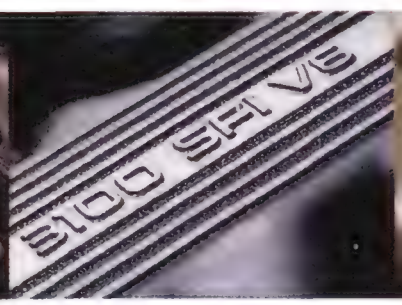

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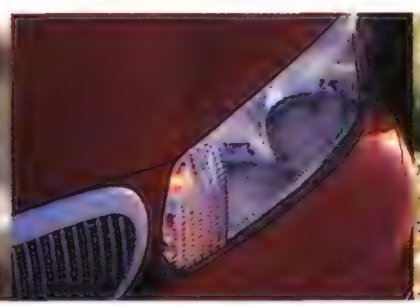

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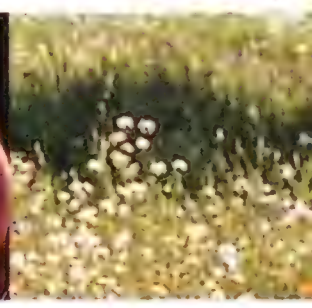

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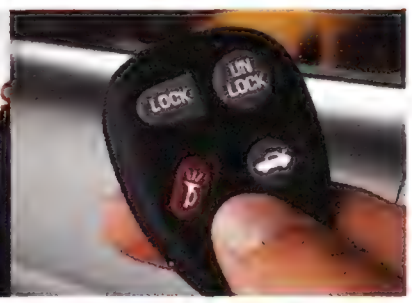

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Diderot's coeditor, Jean d'Alembert, a philosopher and an eminent mathematician, labored for ten years on wide-ranging scientific and mathematical entries.

By Robert Wernick

Declaring an open season on the wisdom of the ages

Under the stewardship of scholars Diderot and d'Alembert, the 18th-century's Encyclopédie *championed fact and freedom of the intellect*

Most everyone in Paris 250 years ago was aware of the band of voluble, enthusiastic men scurrying around town, piling up notes and editing documents for a gigantic publishing enterprise with which they intended to change the world. It was to be called the *Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des métiers* (Encyclopedia, or Classified Dictionary of Sciences, Arts and Trades), the *Encyclopédie* for short. It took all human knowledge for its province, it took a quarter of a century to complete, it sold enough copies to justify its being called among the very earliest commercial best-sellers of modern times, and it did change the world.

This past winter, a giant exhibition celebrating the opening of new quarters for the Bibliothèque Nationale

in Paris, and showcasing library treasures including the *Encyclopédie,* demonstrated just how this was done. The first two volumes of the *Encyclopédie,* which took five years to assemble, appeared in two very handsome and very expensive folio volumes in 1751; the first subscribers had only to open to page 1 to see that something very new was loose in the world. There was the first article, on the letter *A*, starting off quietly enough with a historical summary of the letter and its ancestors, the Greek alpha, the Hebrew aleph. Then the authors of the entry went on to turn the batteries of scorn on previous authorities who had laid down the law on the subject, like the ancient scholar Covaruvias. These authorities had explained that the letter *A* constituted the first sound made by boy babies after being born, it being the first vowel in the syllable *mas,* root of the Latin adjective *masculinus.* Girl babies, the authorities averred, uttered an *e* sound, root of *feminina.* The Encyclopedists (as Diderot and his collaborators have come to be known), disregarding authority, insisted on referring to the behavior of some live babies and reported that they "make different vowel sounds, depending on how wide they open their mouths." A reader of 1997 is unlikely to find anything unusual or objectionable in this observation. But in 1751 it was a war cry of revolt. The Encyclopedists were proclaiming, in an insidiously mocking way, that direct observation of brute fact took precedence over the accumulated pile of ancient wisdom.

Denis Diderot, who wrote most of the *A* article, was never happier than when he could summon up all the ponderous columns of authority that had been tramping down the centuries and blow them away with one gust of rational thought. A few dozen pages after *A*, he found himself dealing with the *Agnus Scythicus,* or Scythian lamb. The names of the authorities roll along like caissons: Scaliger, Kircher, Sigismond, Hesberetein,

As managing editor, Denis Diderot brought a towering intellect and tenacity to the project; he enlisted the greatest minds of his generation as contributors.

Hayton the Armenian, Surius, Fortunius Licetus, André Lebarrus, Adam Olearius, Olaus Vormius, "and an infinity of other botanists." All of them had gone on repeating in their learned treatises the same description of this plant growing on the steppes east of the Black Sea. A remarkable plant not only shaped like a sheep but growing a darkish down all over its body, it was said to make excellent garments and also to be the source of a cure for spitting up blood.

It took centuries of solemn repetition before another botanist, named Kempfer, took the trouble to visit the steppes and discover that there was no such thing as an *Agnus Scythicus*. He found only an outsize but otherwise ordinary fern with a kind of dusky fuzz on its leaves. Reflecting on this episode of human folly, said Diderot, will be far more useful to the mind than the Scythian lamb ever was to the lungs. It was open season on the wisdom of the ages.

The *Encyclopédie* was not at all an ambitious project to start with. It had begun back in 1745 when a printer and entrepreneur named André-François Le Breton formed a consortium to finance a French translation of the popular and widely admired *Cyclopaedia* of the Englishman Ephraim Chambers. This was the latest, and in many ways the best, of the compendiums of human knowledge that had been coming out in a more or less steady stream since a scholar in Athens created the form in the second century B.C. Le Breton's was a very modest project, involving a small capital outlay. But the undertaking soon ran into difficulties, partly because the thrifty publishers hired unskilled translators, with the result that no one could understand what they turned out.

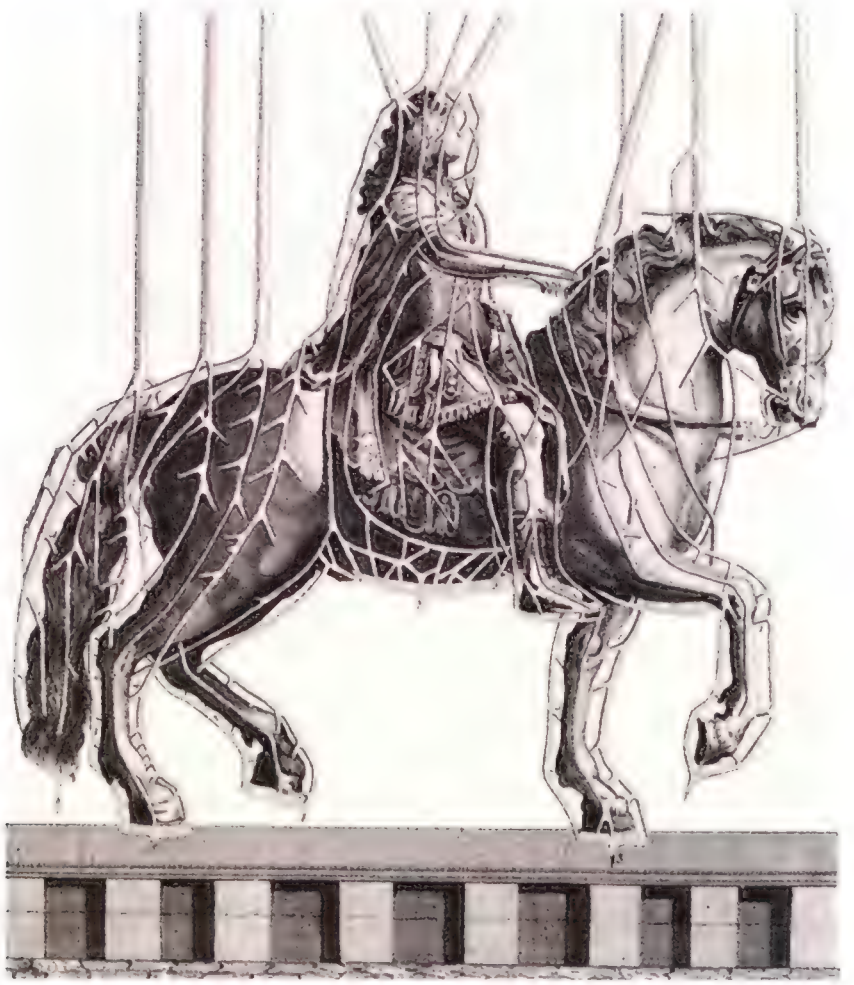
They then called in two of the brightest young lights of the Parisian intellectual world, the all-around man of letters Denis Diderot—described in a police report as "a very bright and extremely dangerous fellow"—and the mathematician Jean d'Alembert. These two saw a chance of turning the project into a manifesto of the new age, the new way of thinking.

They never pretended to have invented the new way of thinking, they were only systematizing it, publicizing it, letting it loose to spread its rays of enlightenment and disperse the clouds of ancient superstition. They traced this intellectual revolution back a century and a half to the great Francis Bacon, Lord Chancellor of England. It was Bacon, said d'Alembert, who first recognized the necessity of experimental physics, which is the basis of the modern scientific-technological world. It was Bacon who wrote in his *Novum Organum* (1620) that it was not enough simply to observe nature. It was necessary to put nature to the question, that is to say, to create experiments under controlled conditions, an approach that has since become known as the scientific method.

Bacon could not shake off all the shackles of the old ways of thinking all by himself. He was taken in, like everybody else, by the Scythian lamb. But he was far ahead of his time in insisting that accurate investigation of the phenomena of the world took precedence over ancient officially approved dogma.

Following Baconian principles, the *Encyclopédie* dealt with the random pieces of vulgar reality on the same level as the broad tenets that held them together. You didn't need a witch doctor or the abstract speculations of Aristotle or Thomas Aquinas to tell you how the Universe worked. In the *Encyclopédie*, it was all set out in crystal-clear prose and engravings. You could learn how to solve mathematical problems and analyze human emotions, how to construct a coal mine, cast an equestrian statue of Louis XIV, fight a duel, make soap. You could consult an entry on how to perform a bladder operation (restraining your patient first in a special surgical chair) or an article on how to study a flea under a microscope. What was new about the *Encyclopédie*'s method was that it mixed the theoretical with the practical. Indeed it had no use for theory without practical application: that was the secret weapon which unleashed the scientific-technological-industrial revolution of modern times.

Everything started with facts, and no fact was beneath the notice of Diderot and d'Alembert. Hence their insistence that the volumes of illustrative plates were as



The Encyclopedists strove to explicate the details that underlay human endeavor. This engraving depicts the lost-wax method for casting figurative sculpture.

Dixie Carter

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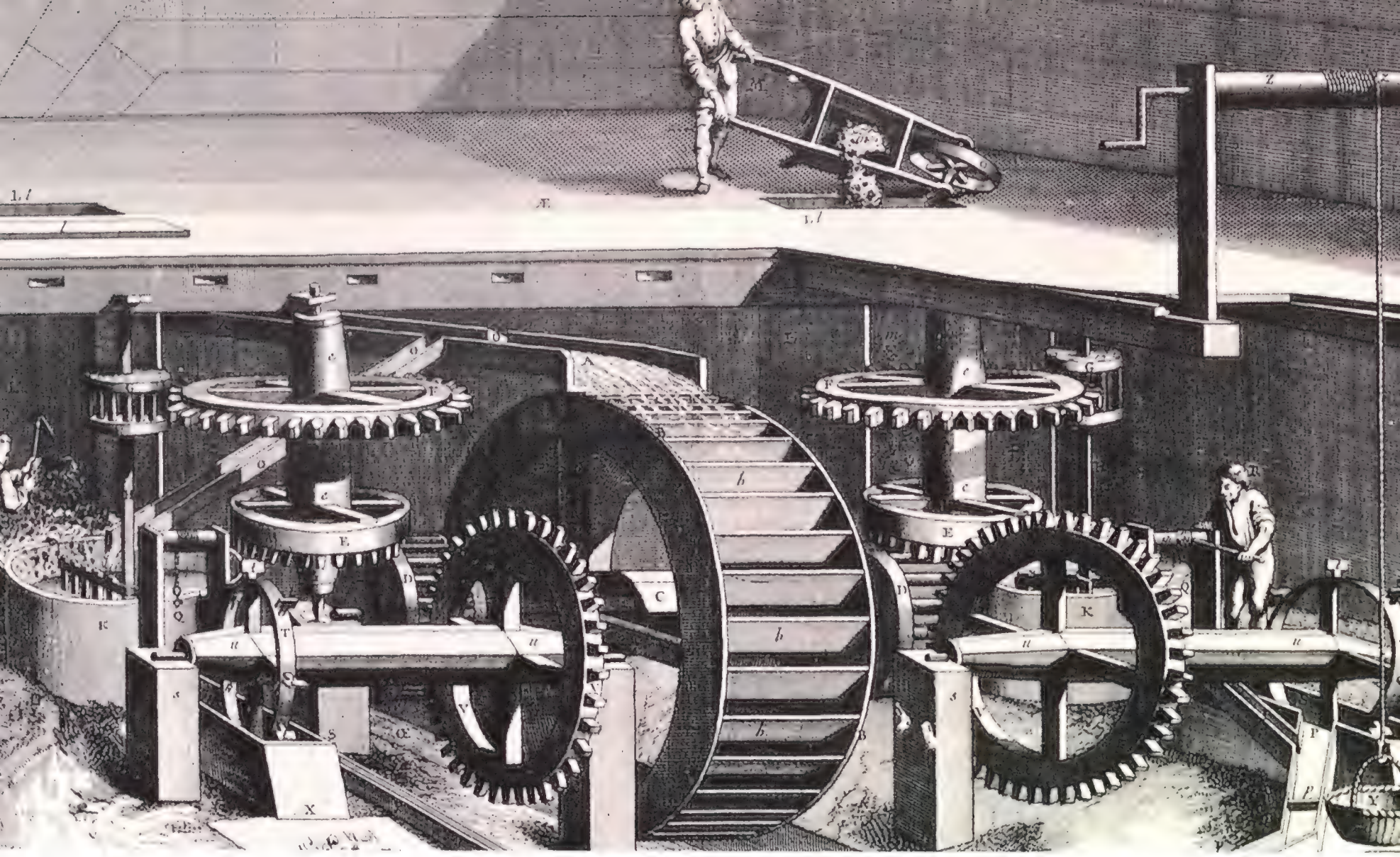

The appearance of the *Encyclopédie* in the mid-18th century coincided with nascent industrialization. The compendium documented emergent technologies, from the washing of molten ore (above) to printing.

important as the volumes of text. They tried to bring everything up to date, to show just how the world was being run at the very moment. It was this more than anything else that distinguished this encyclopedia from all its predecessors.

The editors and authors of the *Encyclopédie* were perfectly willing to devote 20 pages to *l'âme*, the soul, in a long account of metaphysical and epistemological speculation. They also devoted 15 pages to the machine manufacture of stockings, one of the principal industrial products of their day, showing in text and engravings all 86 steps in the process.

Previous encyclopedists had aimed to summarize the arts and sciences. But Diderot and company added a significant word to their title—*métiers*, trades and crafts—insisting that no sharp line could be drawn between theory and practice. Such a line had been drawn as a matter of course in the pre-Baconian past, when the idea of treating the human soul and stockings on the same level of seriousness would have seemed obscene. Aristotle and Thomas Aquinas could reason as well as anyone who ever lived, but it would never have occurred to them to reason about the humdrum tools of daily life.

Diderot, as managing editor of the project, kept a strict eye on his collaborators, even when he had to spend four months in jail, to make sure they were accurate and up to date. He had Louis-Jacques Goussier, the superb draftsman who did more than 900 of the plates, spend six weeks in paper mills, six months in ironworks and glassworks, a month watching anchors being made.

It would take more than 20 years to get out the first edition: 71,818 articles arranged alphabetically in 17 volumes, plus 11 volumes containing 2,885 illustrative plates. New editions, revised editions, supplementary editions, rival editions, would go on appearing for another half-century.

There may have been as many as 300 men (and one anonymous woman) who collaborated on writing the articles of the original *Encyclopédie*. They came from different backgrounds; of those whose backgrounds can be identified, 15 percent were doctors, 12 percent were administrative officials, 8 percent were priests, 4 percent were titled nobility, 4 percent were merchants or manufacturers. They included famous scientists and famous writers like Voltaire and Montesquieu.

Diderot, 34 years old when he started the work, was the son of a provincial artisan and wrote more than 5,000 of the articles himself. He got fairly substantial lump-sum payments from the businessmen who were underwriting the project—royalties for authors were

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unknown in those days—but there were many contributors who worked for no monetary compensation whatever, among them the good-tempered and indefatigable Chevalier Louis de Jaucourt. A learned aristocrat with a noble lineage back to the early Middle Ages, he wrote no less than 17,000 articles.

One of them was the last entry under Z, an article on Zzuéné, or Zzeuene, about which there was nothing to say but that it was a city on the eastern bank of the Nile in upper Egypt not far from Ethiopia.That left the author free to embark on a paean to the completion of the great *Encyclopédie*. In the writer's eyes, this very accomplishment had been foretold by Lord Bacon, who had predicted an assemblage of scholars who would engage in an "admirable conspiracy" to flood with light the world of the arts and sciences. "A time will come," said Bacon, "when philosophers will undertake this effort. Then will arise, from the dark realm of the sophists and the envious, a dark swarm which, seeing these eagles soaring and being unable either to stop or to follow their rapid flight, will try by their vain croakings to belittle their accomplishment and their triumph."

The croakings were not long in coming. The printing of books, at least legally, in France (as was the case in the whole world of the mid-18th century, except for England and Holland) depended like most other aspects of life on what the French called *privilège*. A tight little cartel had the monopoly, and each work they printed had to receive a *privilège*, or license, signed by the king, which indicated his gracious permission.

The king could hardly be expected to put his seal of approval on misleading or subversive works. And there was no lack of authorities to point out that the Encyclopedists made many factual errors, often borrowed (some said plagiarized) the work of others and wrote in a tone that was subversive from the word go. After the introduction, a foldout sheet contained a sort of table of contents in the form of an allegorical tree of knowledge, showing how all human understanding flowed up the one trunk of Reason and out into many branches.

This was a perfectly traditional device, except that in traditional books the root of the tree was Revealed Religion, or Theology. In the *Encyclopédie*'s tree, Theology was only one branch of the limb called Metaphysics, and it in turn was divided into twigs labeled Religion, Superstition, Divination and Black Magic. It was higher up on the tree, but no thicker or more handsome than the twigs farther down, such as Differential Algebra, Spelling, Heraldry, Hydrostatics, Instrumental Music, Drapery, Syntax, Clock-making, Fireworks.

A Jesuit publication, the *Journal de Trévoux*, accused the Encyclopedists of favoring freedom of thought. Why, it was asked, were there so many articles devoted to obscure pagan deities and so few to kings and saints? Why did Abbé Mallet, the priest who wrote the article

For natural history illustrations, the compilers relied, whenever possible, on firsthand accounts from early field scientists. Colored plates here were published by a naturalist, then used as basis for *Encyclopédie*'s black-and-white engravings.

on Noah's Ark, spend no time at all on the Ark's spiritual significance and so much time on ignoble calculations of how big the vessel must have been to hold all those animals, how many man-hours Noah and his sons must have spent cleaning out the mountains of daily manure, how many extra sheep and cattle had to be brought aboard to provide food for the wolves and lions? Pope Clement XIII put the *Encyclopédie* on the Index [of prohibited books] in 1759 and ordered all Catholics who owned a copy of the work to have it burned by a priest, or be excommunicated.

The Encyclopedists might face the threat of jail—or hellfire. They were accused of atheism, free thought, political subversion, corruption of morals. Hitherto, said a bishop, "Hell has vomited its venom drop by drop. Today there are torrents of errors and impieties."

The French government, faced with increasing pressure from defenders of traditional values, took a course, common to all governments, of playing both sides of the board. With one hand it condemned. In 1752, the King's Council ordered the first two volumes of the *Encyclopédie* "to be and remain suppressed." In 1759, the government revoked the license that allowed the *Encyclopédie* to be printed.

With the other hand, it quietly signaled to the Encyclopedists to go on doing just what they were doing. This was possible because the man in charge of suppressing the work was actually devoted to its principles. He was Chrétien-Guillaume de Lamoignon de Malesherbes, a very cultivated and very brave man who 33 years later would again stick his neck way out by undertaking the defense of Louis XVI at the trial that condemned him to death. During the *Encyclopédie*'s early years he was Directeur de la Librairie, the official charged with overseeing the production and distribution of books in France. He was one of the enlightened aristocrats who were convinced that the whole system of *privilèges* and thought control on which the old order was based was both irrational and hopelessly inefficient.

While he acceded to decrees revoking the *Encyclopédie*'s permit, he also found time to give Diderot advance warning of a police raid. And Malesherbes offered his own cellar as a safe hiding place for all the thousands of pages of Diderot's notes and drafts until the police were back in their barracks. He found in the arsenal of French government administrators a pleasant little weapon known as *Permission tacite.* This loophole meant that, for instance, while there might be a decree forbidding the printing of the *Encyclopédie* in France, the publishers might, by greasing the palm of a printer in the Swiss city of Neuchâtel, arrange a sleight of hand. They could issue the last ten volumes in Paris with fraudulent title pages, stating the printer to be one Samuel Faulche & Compagnie in Switzerland.

Malesherbes realized that the *Encyclopédie,* and all it

Louis XV's enlightened director of the press, Chrétien Malesherbes, acted as the project's powerful savior.

represented in the way of freedom of thought and experimental physics, formed the wave of the future. So did Le Breton and other farsighted, greedy and unscrupulous printer-booksellers, who understood that the new thirst for science and knowledge that was spreading through the world was a potential gold mine. They had stumbled onto a best-seller.

It was a stupendous undertaking. The making and merchandizing of books was still, in the 18th century, a handicraft industry, offering deluxe products to the tiny minority of the population that was both literate and rich. Everything had to be done by hand. The production of paper involved an army of homeless itinerant laborers, who turned ragpickers after the harvest was done, and armies of skilled artisans to turn the rags into paper and then print and bind the volumes.

The quantity of paper needed for the *Encyclopédie* was enormous. Printing only the first volume in the quarto edition called for more than a million pieces of paper, and there were 36 volumes in the quarto edition. There were times when the supply of paper ran low; the work was nearly brought to a halt. Even with a steady supply of paper, it took five months of hard labor by five compositors and 20 pressmen to turn out a volume. A barrel of ink cost as much as a printing press, and a bad walnut crop in the south of France or a revolution in the American Colonies might cause the price of ink to skyrocket.

Very little information has survived of the actual details of book publishing before the 19th century. The *Encyclopédie* is an exception. Prof. Robert Darnton of Princeton discovered about 30 years ago in Switzerland a treasure trove in the form of 50,000 business documents and letters in the archives of the Société typographique de Neuchâtel, an important publisher of French books in the 18th century. From them he was able to construct, in an admirably thorough and thoroughly enjoyable book called *The Business of Enlightenment*, a full picture of how a work like the *Encyclopédie* was created, manufactured and sold in those years.

It is not a pretty picture. As far as trade practices and merchandising are concerned, it must be admitted that modern publishing houses, so often denounced for their crass commercialism, are paragons of honesty and integrity compared with their forebears of the courtly 18th century. Publishers routinely lied, cheated, swindled, bribed, conspired and spied. They also often mangled and distorted their authors' texts: an article in the *Encyclopédie* might take a different slant depending on whether it was offered for sale in a Catholic or in a Protestant country.

Diderot came to think that his own work, after it had passed through all these dirty hands, was a "monstrosity." When he was asked to collaborate on a revised version of the work, he replied in a few words of colloquial French best translated as "Get lost."

The fact remained that, for all the wrangling and the mendacities and the troubles with the law, the volumes kept coming out—for the very good reason that the bottom line always showed a more than healthy profit. The publishers made money on a scale that had never been seen before in the book business, and that would not be seen again till the arrival of mechanized publishing and cheap pulp paper in the middle of the next century.

By 1789 almost 25,000 sets of authorized folio, quarto and octavo editions printed more or less legally in Paris, Lyon, Geneva, Neuchâtel, Bern, Lausanne, Lucca and Leghorn had been sold throughout Europe. At an average of 30 volumes per set, that makes three quarters of a million books—an extraordinary figure for the time.

The first folio edition was terribly expensive, affordable only by very rich people like government ministers, archbishops, Russian princes, German princelings. But as fiercely competitive publishers poured out less-expensive quarto and octavo editions, the *Encyclopédie* came to be read by more and more thousands of more or less ordinary people. It was still far beyond the reach of most of the population. A skilled locksmith or printer

A frequent contributor, Robert Wernick writes from Paris for part of the year. He reported recently on the restoration of a château in the French countryside.

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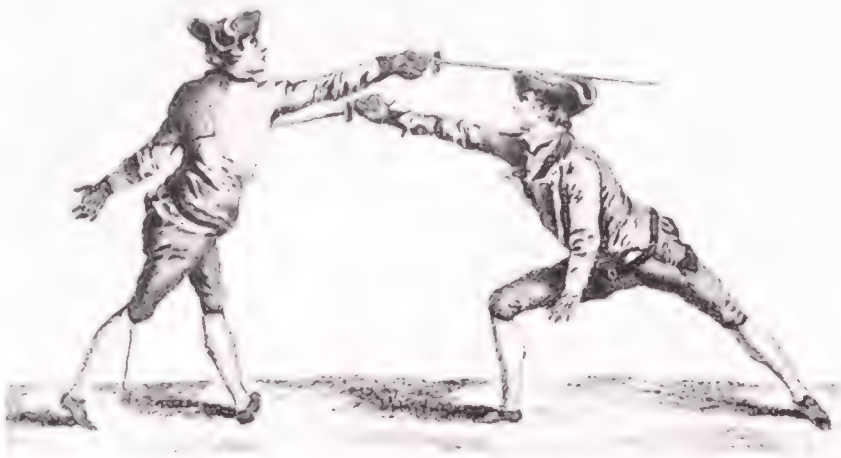


Omnivorous contributors reported on everyday life, too. The entry on fencing tried to estimate casualties.

would have had to cough up the equivalent of fifteen and a half weeks' wages for the cheapest octavo edition. If Diderot had had to buy it, it would have taken four and a half weeks of his pay for the project. Still, the publishers had judged that there was a huge untapped market for books like this; their profits went up all around.

No one can tell how many people actually read the *Encyclopédie,* but by the standards of the time it was surely very considerable. Everyone in Europe who wanted to keep up with current knowledge and current standards had to read it, or at least say he did.

Apparently few if any copies got to Colonial America. But American revolutionaries had imbibed the 18th-century intellectual discourse that created the *Encyclopédie.* Benjamin Franklin was acting in the spirit of the philosophes when, after sages had been speculating for untold centuries about the nature of lightning, he put a kite up in the sky in an effort to find out.

Jefferson was following the Encyclopedic rules when he heard that pious people were saying that shellfish found at the top of mountains in fossilized form must have been put there by Noah's flood. Jefferson didn't buy the deluge explanation. He took time out to calculate that if all the moisture suspended in the earth's atmosphere were to be condensed into water, the oceans still would not rise halfway up the mountains.

By the time the French Revolution broke out in 1789, Diderot and d'Alembert and many original contributors were dead. However, a new generation had come along to digest the enormous mass of new theoretical and technical knowledge that was piling up year after year. The new Encyclopedists were less philosophical, more technical and more specialized than the old. The new version in 229 volumes that came out between 1781 and 1832 was called the *Encyclopédie Méthodique* (Methodical Encyclopedia). But the Encyclopedists' aims and their methods were in fact basically the same.

Their enemies were quick to proclaim, and have proclaimed ever since, that the Encyclopedists were responsible for the French Revolution, the Reign of Terror, the guillotine and all the horrors of the modern world. Their friends were equally quick to give them credit for the rise of liberty, universal suffrage, freedom of the press and all the progress of the modern world.

The Encyclopedists had no common political program, and their direct influence on political and social events was probably very small. Darnton's analysis of the account books shows that most of the sales went to people very much like the Encyclopedists themselves, upper-class people brought up in a world of privilege and unchallenged authority. An edition that sold 338 copies in the placid provincial town of Besançon, where the population of 28,000 consisted largely of priests, professors, lawyers, officials and landholders, sold only 28 in Lille (pop. 61,000). In that city, the inhabitants were starting to build factories that would change the face of the world, but the people building them were too busy to read anything beyond their balance sheets.

Keenly aware of change, the Encyclopedists had little more prescience than anyone else of how the change was coming. They lived at the dawn of the Industrial Age but could scarcely grasp what would come of it. The technology they admired and illustrated so lovingly was a highly developed handicraft, mostly devoted to luxury goods like stockings and watches. They were not themselves revolutionaries, though their belief in free inquiry and their contempt for irrational authority must have had considerable influence on revolutionaries.

When the revolution in France did come, dismantling the whole vast structure of privilege at one swoop, they had different opinions about it, responded in different ways and had different fates. Some were guillotined,

some were pressed into service to make saltpeter and cannon, and to create a rational system of weights and measures. The naturalist Daubenton was asked to dissect a rhinoceros from the former king's menagerie for revolutionary leaders eager to disseminate knowledge.

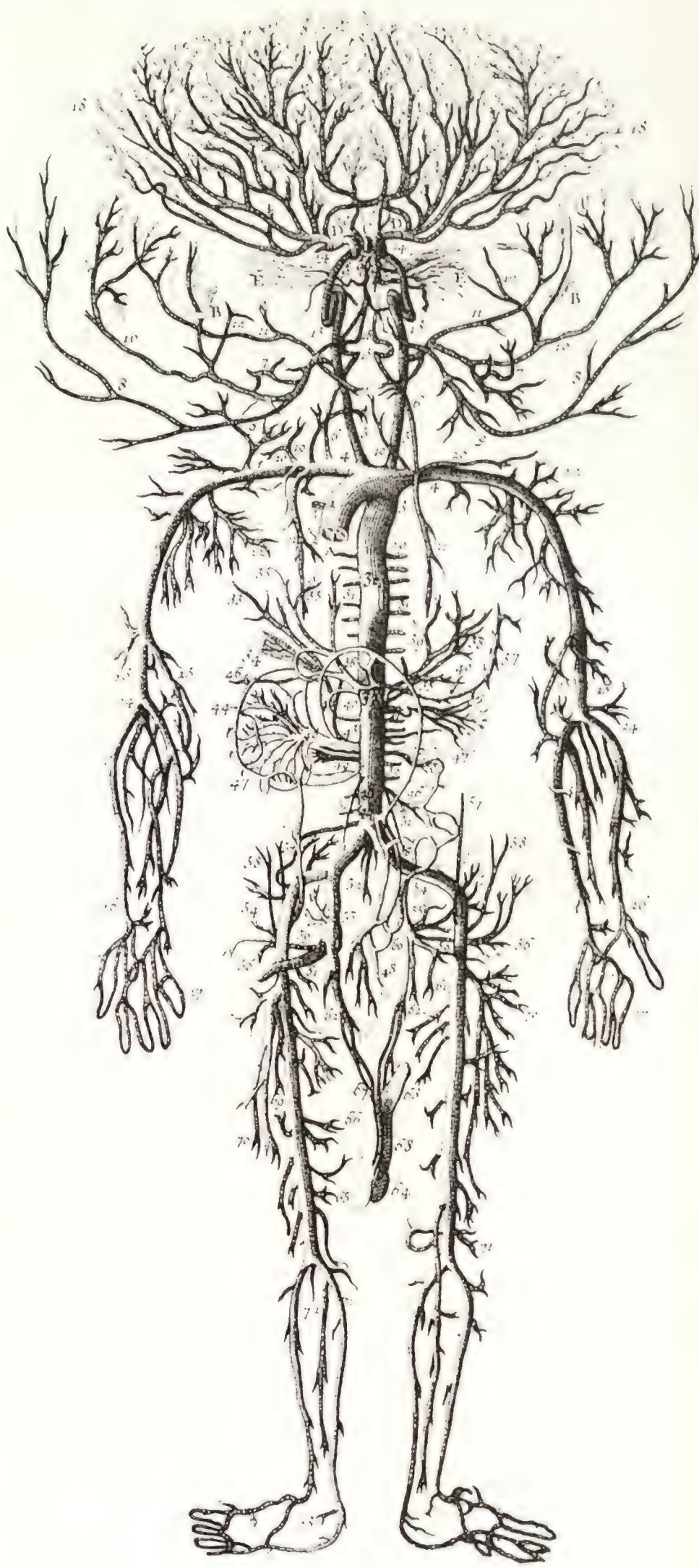
The great mathematician Condorcet, who had hailed the revolution but had voted against the death penalty for the king, was forced to flee for his life. It was while hiding from the authorities that he wrote his classic demonstration that the progress of knowledge proved that "nature has placed no limit to our hopes" and that the human race was bound to approach ever closer to perfection. Wandering in the country, and starving, he ordered an omelet in a country inn, and when they asked him how many eggs he wanted in it, he faced one of those unexpected practical problems that pop up in times of great social change. He was a marquis by birth, and there would have been no reason for him at any time in his life to see the inside of a kitchen. He answered at random, a dozen, raising doubt as to the reality of his claim to being an unemployed worker. He was thrown into jail and died there, perhaps having swallowed the poison he had hidden in his ring in order to avoid the guillotine.

Most of the surviving Encyclopedists were content to wait out the revolution, and eventually got jobs at universities and government institutes, continuing to amass and channel and analyze the immense flood of knowledge pouring at an ever increasing rate over the earth.

Whatever happened to the individual Encyclopedists, the *Encyclopédie* itself survived. The solemn old volumes may sit unread in libraries, but some of the livelier articles are continually being reprinted in anthologies of 18th-century prose.

Few people today share the Encyclopedists' ingenuous faith that human knowledge could be satisfactorily summarized in 28 volumes or in 229 (as the last *Encyclopédie* numbered) or that greater diffusion of knowledge must lead to greater happiness for mankind.

But in a sense the *Encyclopédie* has been triumphant. The spirit of Lord Bacon, the combination of free curiosity and empirical evidence, roams unchecked over most of the world. When the Catholic Church, which once ordered the *Encyclopédie* to be burned, wished to settle the question of whether the Shroud of Turin really wrapped a crucified man 19 centuries ago or was created by an artist some centuries later, it did not rely on consultation of ancient authorities, as Pope Clement XIII surely would have done. It sent the Shroud to a laboratory. This is just what Diderot would have advised.



The developing science of medicine intrigued the Encyclopedists: diagram depicts the arterial system.

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By Chiori Santiago

Ziggedy bop! Tap dance is back on its feet

It's been a mainstay of stage and screen; now, after years in revival, a truly American art form returns full force, with energy and innovation

Michal Daniel

On Broadway, Savion Glover (above, with hat) and the cast of *Bring in 'Da Noise, Bring in 'Da Funk* tap with power and intensity, in contrast to the poised chorus-line tappers (opposite) in the 1933 movie *42nd Street.*

"How does that part go again, Savion?"

Savion Glover wipes the sweat from his brow with the already-damp towel hanging around his neck. A studio full of dance students—mostly women, a few men, of every age, shape and color—waits expectantly. He turns, faces the mirror, gives the instruction in the clearest language he knows:

"Ziggedy bop," he says. His feet tap the wood planks of the studio floor in a crisp drumroll, echoing the phrase. Ziggedy bop. His hands dangle loosely at his sides; he leans forward a bit precariously, as if on the verge of falling. The dancers nod. A few tentative ziggedy-bops pepper the room, gathering to a thunder as the piano pounds through "Ain't Misbehavin'."

If you want to tap-dance like Savion Glover, you can do it with your eyes closed, but your ears had better stay wide open: this dancing is meant to be heard as much as seen. At the moment, it's making itself heard loud and clear in all its variations; from Fred Astaire grace to hip-hop antics, tap dancing—a truly American art form—is once again rat-a-tatting into the nation's consciousness. Glover is the latest messiah of a form that's loose-limbed, individual and inspired by the syncopated beat of urban life.

"My trademark is just rough funkiness. I like to get people moving, keep their heads bobbing," Glover explains as he catches his breath after class. "Instead of the Broadway style, where I'm thinking about whether my [right] arm is coordinated with my left, my style is more natural. I say to the students: concentrate more on the

Photographs by Theo Westenberger

rhythm of the dance. I teach them music instead of choreography. I teach them a nice conversation.When I'm dancing, I'm just spitting out those verbs."

Glover's feet tell the history of tap dancing in his award-winning Broadway show, *Bring in 'Da Noise, Bring in 'Da Funk.* When I spoke to him some time back at the San Francisco Tap Dance Center, where he was teaching a master class, the show was still an idea dancing in Glover's head. At the time, he was playing a young Jelly Roll Morton in the touring production of *Jelly's Last Jam,* a show that helped put tap back in the public spotlight.

But Glover wanted something more, something that spoke to a new generation of tap dancers who grew up with techno-punk music and hip-hop poetry. He didn't want tap dancing to wear a tuxedo; he wanted to present it as a muscular, improvisational dance—an art form that felt comfortable in a T-shirt and baggy shorts. When the *Jelly* tour finished, he flew back to New York to begin working out his concept with director George C. Wolfe at the Joseph Papp Public Theater.

"The show is basically about the dance, going back to the beat," Glover said. "We're looking at the roots, from African shouts to New Orleans, where people started putting bottle caps on their shoes; who did the dance, how it transformed, where it went."

"Shoes talk with Shakespearean richness"

A year later, Glover's dream had come true. *Bring in 'Da Noise, Bring in 'Da Funk,* choreographed by Glover, 23, and starring a handful of phenomenal young tappers, captivated hard-boiled theater critics. "Shoes talk in this revelatory show, and with a vocabulary of Shakespearean richness," crowed the *New York Times.* "The most glorious dancing Broadway has seen in years," insisted *Newsweek.* The show garnered four Tonys, including a "Best Choreography" award for Glover.

Offstage, Glover scuffs along the street in acid-green baggy pants, a black satin jacket and huge high-top sneakers. He has a perpetually sleepy-eyed look. Talking about tap, however, ignites his passion: "Why I'm in tap is—to keep the dance alive," he says.

He has plenty of company. Tap fans are a growing legion. In 1989, when Congress established National Tap Dance Day on May 25 (the birth date of tap master Bill "Bojangles" Robinson), just one festival in Washington, D.C. commemorated the occasion. Now, 42 cities and 12 countries have joined the annual tapping frenzy.

From 6-year-olds to septuagenarians, they're packing tap dance classes at studios, senior centers and recreation halls. In tiny practice rooms in Manhattan, young women from Holland and Germany study with veteran tapper Buster Brown. In South Africa hundreds of dancers celebrated a recent Tap Day by donning grass skirts and tapping to "Shosholoza," the theme song of the country's champion rugby team. International touring shows such as *Tap Dogs,* performed by Australian dancers in work boots, and *Riverdance,* which explores tap dancing's roots in the Irish jig, are rousing audiences to the hypnotic allure of rhythmic dance. And every August, thousands crowd Manhattan's streets for Macy's annual Tap-O-Mania extravaganza.

Tap dancing is contagious. As I watched a couple of tap devotees trade steps recently on a plywood floor in a garage in Oakland, California, my feet itched. A week later, wearing a pair of battered hand-me-down shoes, I join a beginner's class in Berkeley. I'm surprised to find my next-door neighbor there, too. A stoic father of four, he's the last person I'd expect to find in a dance class. But as I soon discover, tap dancing—while I wouldn't describe it as simple—is more accessible to the average person than, say, a pirouette on pointe.

Tap dance styles often defy categorization. What some dancers call rhythm tap, also known as jazz tap, is highly improvisational—as exemplified by Glover's command to "ziggedy bop." A dancer produces intricate syncopations, oftentimes working close to the ground. Rhythm's restrained cousin is show, or Broadway, tap, embodied in the unified poise of a Rockettes chorus line and the ballroom grace of a Fred Astaire. Show tap owes much to ballet and modern dance, with an emphasis on posed arms and erect upper body carriage. In contrast to ballet, gravity is a friend in many tap routines. The aim is to create a small contact point between foot and floor, as if you're rapping someone on the shoulder to get her attention.

Taking my first steps, I struggle to keep ankles limp, weight balanced, shoulders down, just for one tentative forward slide of the foot followed by a quick brush back, like a pony pawing the ground. My reward is humble and instantly gratifying: one click of a metal-capped toe against the pitted wood floor.

As I hop from one foot to the other, I understand why tap dancing is so popular among people old enough to know better. Rhythm tap's emphasis on sound allows us to ignore the physical fanfare of kicks and turns in favor of tiny movements, shudderings almost, extracting maximum resonance for minimum effort. Which is why many tappers are still going strong in their eighties, and why novices can brush-step-heel-drop with panache after only a few lessons. The basics of tapping seem almost as easy as walking across the floor.

That's according to Rosie Radiator, San Francisco's tap guru, a woman who once taught tap to a group of barefoot Buddhist monks. Her attention-getting stunts make more conventional instructors fume (she is in *The*

Before taking tap for this story, the author, who is based in San Francisco, learned to tango when she reported on that dance in the November 1993 issue.

Above: Yvonne Edwards, left, and Renée Kreithen rehearse a step with their Tappers With Attitude troupe in Washington, D.C. Below: thousands of dancers pound Manhattan streets in Macy's Tap-O-Mania.

Brothers Harold, left, and Fayard Nicholas loaded their tap dance routines with stunning acrobatic feats, including the high-flying splits that thrilled audiences in 20th Century Fox's 1941 movie *Sun Valley Serenade.*

Guiness Book of World Records for leading a group in a 9.6-mile tap dance through San Francisco). Radiator runs the Tap Dance Center, where I join a group lesson.

As we enter the studio, we're asked to leave our preconceptions, and our shoes, at the door. The studio provides students with specially designed tap shoes, boxy in form and made to fit loosely above the toes. The pairs we're lacing on today are covered in red sequins, so we look like a herd of Dorothys about to click our heels together and fly away from Oz.

We clack into the studio where Radiator, slender and long-limbed, points a finger at her assembled students as if delivering the word from the pulpit. "As long as people have been walking the earth there has been the sound of feet on the ground," she explains. "That sound became Spanish flamenco, Indian kathak, Romanian boot dancing, Irish stepdancing and clogging. Every culture has some form of sound-producing dance.

"We do not dance to music, we make music," she emphasizes. "We stand on our instrument. Not only that, we play the building." We proceed to do just that, loping around the room in a technique known as "sloppy walking." We're rewarded by little trills and murmurs of sound as our metal-plated shoes graze the floor. It takes me back to the tomboy I was at age 7, and the restless, natural motion that propelled me along the sidewalk. "Straighten up!" my mother would holler. "And stop scuffing your shoes!"

Other memories from my childhood come rushing back in the percussive lingo of tap. Girls spent recess in our schoolyard singing ditties accompanied by a complex set of rhythmic claps and pats on the knees and chest. One of those chants went: "Juba this and Juba that, Juba killed a yellow cat." None of us knew what it meant. But now I could hear the same rhythm in the shuffle-step dance pattern of my tap routine.

As it turns out, there was a real-life Juba, William Henry Lane. Probably the first famous figure in tap dancing, he got his stage name from a word that signified a dance and a rhythm that Africans brought to America. In the 1840s, theater handbills announced Lane's arrival as "The Wonder of the World, Juba . . . the King of All Dancers" and proclaimed, "No conception can be formed of the variety of beautiful and intricate steps exhibited by him with ease." Born a freeman in Providence, Rhode Island, Lane's interpretation of the Irish jig, with plenty of his own improvisations thrown in, had earned him acclaim and privilege few African-American performers enjoyed. Having demolished his rival John Diamond, a white man famous for jig dancing, in several competitions, Lane was the only black dancer of his time to receive top billing with four white performers (who, in blackface, called themselves the Ethiopian Minstrels).

Lane embodied a living rhythmic history that was Africa's gift to American culture. West Africans brought here on the cramped and filthy ships of the slave trade were sometimes allowed to stumble topside where, for exercise, they were forced to dance, on occasion, to the unfamiliar sound of hornpipe, banjo or fiddle. On those pitching, creaking decks the Africans, with their "foot stomp," fluid hip movements and polyrhythmic

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communion with the earth, most likely were exposed to the march-time beat of Europeans for the first time. Later, installed on plantations, the Africans became adept at copying Irish jigs, quadrilles, Virginia reels and Lancashire clogging, and were called into Big Houses around the South to entertain guests with their footwork.

On their own, the transplanted people of Dahomey, Congo and Senegal were more apt to dance *giouba*, described by one writer as "an African step-dance which somewhat resembled a jig with elaborate variations, [which] occurred wherever the Negro settled." Rhythmic clapping sometimes went along with the steps. This tradition, known as "patting Juba," would be preserved by my playmates in a California schoolyard in 1960.

Drums can be outlawed but not the beat

The direction that the African step dance took might have been different were it not for the Stono uprising in South Carolina in 1739. On a September Sunday, 20 insurrectionist slaves broke into a munitions warehouse near Stono River, armed themselves, set fire to several homes and killed ten white residents. With flags flying and drums beating, the group grew to 60 before their progress was halted by the local militia. The next year, the slave code was revised to restrict the "wanderings and meetings of negroes and other slaves" and outlawed "the using or keeping of drums, horns or other loud instruments, which may . . . give sign or notice to one another of their wicked designs and purposes."

Drums could be outlawed, but the impulse to make rhythm was not so easily arrested. The slaves became masters of improvisation to keep the beat alive: the drummer became a dancer and the drum became a barrelhead, a wooden sidewalk, a juke-joint tabletop or a piece of board hauled out for an impromptu performance—anything that could answer one's shoes with a satisfying rumble of sound.

By the turn of the century, tappers were a fixture on the vaudeville circuit. Though often part of a buffoonish skit, tap dancing was a ticket to show business for many blacks. That was true for tap's godfather, Bill Robinson. As a child, he shined shoes for a nickel and danced for pennies in front of the Ford Theater in Richmond, Virginia. Although he would eventually acquire a suave, top-hat-and-tails stage image, Robinson spent much of his life getting in and out of mischief; he was a dedicated gambler with a short temper and an easily bruised pride. Tap dancing saved him more than once.

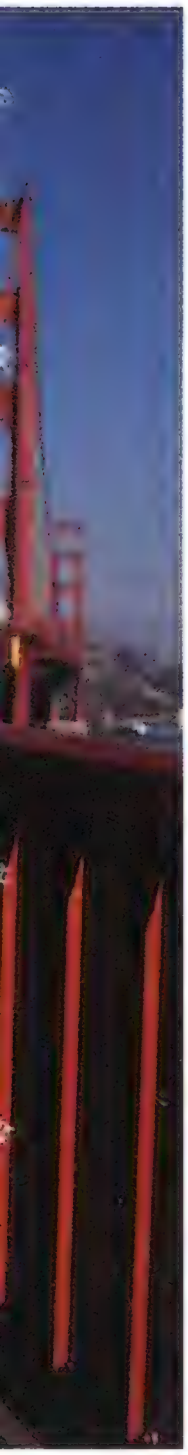
A childhood friend, Lemmeul Eggleston, told Robinson's biographer how the dancer's fast feet pulled the boys out of one early scrape. Accused of stealing a sack of peas, the two were hauled to the police station. Bill danced all the way up the steps and kept dancing once inside. Transfixed, the officers didn't notice Eggleston

Rosie Radiator, San Francisco's dance guru, started a tradition of tapping across the Golden Gate Bridge.

make a getaway. In the ensuing confusion Bill, too, managed to slip out.

That may have been the origin of the stair dance that became Robinson's trademark. Another story has it that in 1918, while dancing as a solo act in vaudeville, Robinson spotted friends in the audience and impulsively danced down the stage steps to greet them. The audience loved it. Robinson perfected the routine and had a collapsible stairway built to take on the road.

New York lured dancers then as it does now. They rode in to the ratcheting noise of a train's wheels and found the city's heartbeat in a subway car rolling up to Harlem. "Everyone would be swapping steps; there were guys who actually knew how to sleep and move their feet at the same time," recalls 83-year-old Buster Brown, who tapped the show circuit in the '30s. Fred Astaire used to trade steps with John "Bubbles" Sublett, known for his fast-paced syncopation. One night Astaire went to a Harlem club to watch a tapper do a complicated routine.



Her intriguing array of dance footgear includes ballet slippers with taps (top) and sequin-spangled shoes.

When Astaire duplicated the steps with ease, the dancer, surprised and impressed, blurted: "He can dance! Does he want a job at the club?"

During the 1920s and '30s, tap dance emerged as the star of the show, clattering its way into nightclub acts, Broadway revues and movies. Performers added all sorts of tricks and flash to make their tap routines stand out. They danced on roller skates, with hula hoops, on suitcases. Some, like Sandman Sims, sprinkled the floor with sand, producing a laid-back sound like a jazz drummer's brushwork. The Nicholas Brothers, Fayard and Harold, were just boys when they opened at the Cotton Club in New York, but in a few years they earned Broadway and Hollywood renown by leaping off scenery and landing in bone-crunching full splits.

Women tappers often were relegated to the chorus line, but a few stood out. Clad in trousers, Jeni LeGon did flips and splits. Ruby Keeler was a buck-and-wing star. Eleanor Powell partnered Fred Astaire but was also a screen idol in her own right. Long-legged Ann Miller could execute 500 clicks per minute.

Tap gradually grew more sophisticated as dancers tried to polish the dance's lowbrow image. The fluid moves of Honi Coles and Cholly Atkins or Jimmy Slyde and Bunny Briggs personified "class" tap acts and "society" dancing, while Paul Draper added ballet moves and classical music to his routines.

Genuine hoofing hit Broadway in 1921 in *Shuffle Along,* an all-black musical revue that made stars of singer Florence Mills and of a goofy teenage chorus girl named Josephine Baker. But the real stars were the time step, the buck-and-wing and the other tap routines that had been the mainstay of minstrel shows and vaudeville. In much the way *Bring in 'Da Noise* refreshes Broadway today, the dancing in *Shuffle Along* astounded critics then. After that show, according to one critic, "all stage dancing underwent a change—steps became more intricate, daring, perilous."

The "humble buck-and-wing" goes upscale

The success of *Shuffle Along* was followed by *Blackbirds, Brown Buddies,* Ziegfeld's *Follies* of 1922 and other revues that showcased tap dancing. By the 1930s, Astaire, Robinson and others had taken their talking feet to the screen. Robinson taught 7-year-old Shirley Temple a simplified version of his stair dance, which they performed on a grand staircase in *The Little Colonel.* Audiences were captivated by the twosome, and Robinson's Hollywood career took off.

America's most famous dancing film duo, Fred Astaire and Ginger Rogers, represented the elegance of tap. Astaire hated the formality of ballet and tried to keep it out of his choreography; ironically, it was his dapper tuxedoed image gliding across the movie screen in more than 30 films that took tap upscale. After his movie *Top Hat,* which indelibly impressed the image of the suave, white-gloved tapper on the public's mind, the *New York Daily News* noted that Astaire had transformed the "humble buck-and-wing into an art."

Astaire had been influenced by African-American tap dancers early in his career, noted Hermes Pan, Astaire's dance collaborator."The first thing I showed him was a broken rhythm thing, and that appealed to him. It's a black tradition, and I learned it from blacks in Tennessee." After "fiddling around" with tap, Astaire once said, "I made up my own way of doing it."

On a late-August morning in Manhattan, the sound of jackhammers biting into concrete and the counter-pulse of taxi horns provide background music for the 6,500 amateur tap dancers who've converged in front of Macy's on 34th Street for the annual Tap-O-Mania. From fresh-faced tots to 89-year-old Agnes Lundgren, who started tapping when she turned 79, they've come from

With fancy footwork and charisma, Bill "Bojangles" Robinson achieved Broadway and Hollywood success.

Long Island and Connecticut, New Zealand and Japan for the chance to dance two minutes in "the greatest assemblage of tap dancers in a single routine." Moments later, the sound of 13,000 feet slapping the pavement joins New York's cacophony in what Carol Vaughn calls, warmly, "a euphoria of bad taste."

Vaughn is a tap professor and cofounder of Washington, D.C.'s Tap America Project (TAP). To call attention to tap dancing, she's organized some attention-getting stunts herself. She once dressed 88 dancers as black-and-white piano keys and got them to tap-dance down the stairs of the Jefferson Memorial in honor of Fred Astaire's birthday. In 1989, at TAP's urging, Congress passed the bill establishing National Tap Dance Day. Now she prods dancers to "stamp for the stamp" in a drive to create a commemorative postage stamp honoring tap dance. "Hey, whatever gets people to realize that tap is our indigenous art form, cool," Vaughn says.

Tap hasn't always been so popular—it entered a dormancy in the 1950s and '60s, supplanted by ballet, the Beatles and Black Panther militancy. Ballet became Broadway's darling after choreographer Agnes de Mille revolutionized musical theater by introducing balletic style in the 1949 production of *Oklahoma.* Within a decade, big tap numbers disappeared from musicals.

Honi Coles ended up managing New York's Apollo Theater, once a vaudeville center, only to watch rock-and-roll acts edge tap dancers off the stage. His partner, Cholly Atkins, went to Motown, where he choreographed routines for such groups as the Temptations and the Four Tops. He preserved tap moves without the tapping. When you see Michael Jackson flash his feet and pull up in a dramatic toe stand today, you're watching Atkins' legacy.

In the 1960s and '70s, with African-Americans' new sense of identity born of black militancy and the Civil Rights Movement, Bojangles' wide grin and rolling eyes were no longer endearing to black or white audiences. "From an African-American perspective, things needed to change," says dancer Gregory Hines. "Bill Robinson, Louis Armstrong, and their style of performing came under a lot of scrutiny and criticism. The things that made Robinson politically taboo were the saucer eyes and smiling all the time." (Robinson asked to be photographed without the big grin, but his Hollywood publicists wouldn't comply.)

"It's painful to think that people like Robinson have been somewhat lessened," adds Hines, who hopes to portray Robinson in film someday. When Hines developed his first solo show as a tap dancer in 1978, however, it was with a stage look that was the antithesis of Robinson's. Hines wore sleeveless muscle shirts, and his hair was a hip Afro halo; a small gold hoop adorned his ear. Tap was exciting again.

"I always thought I got too much credit for the so-called revival of tap dancing," Hines said. "Young white women had a lot of impact on tap coming back. I remember coming into communities for concerts, and after a show I would meet the tap teacher—you know, a Miss Robbins who's been teaching in Buffalo for the past 30 years. It's those people, at that grassroots level, who kept tap dancing alive."

They include people like Renée Kreithen and Yvonne Edwards, who run a Washington, D.C. tap school and a repertory dance company called Tappers With Attitude. Two alumni are Joe Webb and Baakari Wilder, now in the cast of *Bring in 'Da Noise, Bring in 'Da Funk.* As Macy's workers sweep the street of lace garters and streamers left in Tap-O-Mania's wake, the kids of Tappers With Attitude are piling out of a van at Lincoln Center, stretching after the long ride from the capital to New York.

Gregory Hines' Broadway roles helped revive tap, but he says dance teachers also played a major part.

They're here to dance in Lincoln Center's summer outdoor performance series. Kreithen gathers the kids together for a pep talk before they move backstage. "Don't forget to look at the audience. Don't look at your feet," she says. "And have fun."

First on the bill are Webb and Mya Harrison. A quiet young woman with a face as sweet as a doll's, Harrison turns into a warrior on the boards. Her feet, barely lifted from the ground, execute rapid-fire rolls, shouting at one moment and whispering the next. She doesn't need music. Her shoes make their own a cappella chorus.

"Close your eyes," she tells the audience. She cocks her head to one side, listening as her taps ricochet off the stone faces of the surrounding buildings. "Hear the beat?" Webb joins her in a call-and-response pattern. They're playing jazz, as if drummers Max Roach and Roy Haynes are going head-to-head on traps. Then the tappers show off the dance's versatility in "All Blues / Tacit / Latin," choreographed by tap trailblazer Brenda Bufalino to a Miles Davis score. "You can tap to any kind of music," insists one young dancer.

Just to make sure, I try a few steps to my son's Green Day album when I get home. I survive to report that, yes, it is possible to tap-dance to San Francisco punk rock. What makes tap so beautifully subversive is that 250 years after the Stono silencing, millions heed the steel-tinged voice of some censored Americans who managed to turn the whole world into a drum.

By Andrea Gabor

Even our most loved monuments had a trial by fire

Controversies like those swirling around the FDR Memorial are the rule when Americans try to agree on anything to be cast in bronze

FDR never wanted a monument for himself. And who could blame him? It was he who watched with growing dismay, throughout the Depression and much of World War II, as battles raged over the proposed Jefferson Memorial. Today, that circular, domed edifice beside the Tidal Basin seems a stately embodiment of the Republic itself. But back then, it was a lightning rod for critics, and when it finally seemed it would never get built, Franklin Roosevelt personally intervened.

Now a half-century has gone by, and it's Roosevelt's turn to be honored. No surprise, then, that the FDR Memorial, which will be dedicated on May 2, caps a decades-long controversy that rivals not only the fight over the Jefferson Memorial but also those that have engulfed other monuments and public sculptures—both major and minor—over the years.

Controversy has been as integral to public art in the United States as bronze and marble. In the 19th century, politicians and art critics sharpened their knives on everything from the now venerable Washington Monument to those seemingly innocuous lions outside the New York Public Library. In fact, trial by fire has been almost a rite of passage for even America's most beloved monuments and memorials. "Never was a memorial yet erected that was not subject to criticism," lamented a besieged Rep. John Boylan before Congress in 1937, as he sought to win backing for the Jefferson Memorial. Sixty years later, Bert Kubli, who ran the Art in Public Places section of the National Endowment for the Arts until retiring in 1995, countered: "If no one debates it, why have it? The process and the debate are very much a part of public art itself."

Of course, Americans haven't cornered the market on monumental controversies. Even Paris' signature structure, the Eiffel Tower, was deemed ugly when it went up. But the debates here often turn into high-stakes battles over our values and the very "definition of what it means to be American," writes Harriet Senie, coeditor with Sally Webster of *Critical Issues in Public Art.*

One reason for this long history of acrimony is that, in many respects, monument building runs against America's democratic and puritanical grain. In the early years of the Republic, many Americans viewed any public sculpture as an extravagance. Also, although we have frequently had trouble agreeing on a common identity, nearly all of us have shared a discomfort with the old-world social and religious order depicted in classical sculpture. Finally, the costs and politics of getting a monument built often have led the advocates of a particular project to assume near-autocratic powers.

The fight over the Jefferson Memorial spanned an eclectic range of objections from art criticism to environmentalism. John Russell Pope's Pantheon-inspired design was derided as an "imitation classical building . . . [that] immortalized the very pomp and pretense [Jefferson] always fought." Joseph Hudnut, dean of the faculty of design at Harvard University, concurred: "This monument, when completed, will embody so grotesque a presentation of Jefferson's character as to make him, if such a thing is possible, forever ridiculous."

Meanwhile, the debate in Congress degenerated into what Representative Boylan called a "showdown" over the destruction of cherry trees around the Tidal Basin, where the memorial was to be located. In 1937, in one long and impassioned defense of the trees, Rep. Allen Treadway proclaimed on the House floor: "I want the

Opposite: At the foundry, pieces of Neil Estern's sculpture of a seated FDR await assembly. Above: A model shows what the finished work will look like.

House at this time to understand that the people of the U.S. want the Tidal Basin and the cherry blossoms protected and we are going to have them protected by legislation if it is possible to do it." Boylan shot back that "not a single cherry tree [would] be disturbed."

In the spring of 1938, after witnessing years of unproductive debate by Congress, a fed-up FDR approved both the site and a modified version of Pope's design, pushing through a $500,000 appropriation to begin construction. But the First Lady didn't share his enthusiasm. In what was almost certainly an act of defiance, in the April issue of *Reader's Digest* Eleanor Roosevelt wrote a paean to the trees, which read in part: "I hope that neither ax nor water will harm them." The trees had become a cause célèbre, as people chained themselves to the trunks in protest. When construction got under way, the National Park Service took to removing the trees at night; eventually, 150 were destroyed or moved.

Ferocious as it was, the battle over the Jefferson Memorial was tame compared with the earlier, century-long war over the Washington Monument. As art historian Kirk Savage has observed, the effort to build a national monument in Washington's memory became "the most problematic undertaking in the campaign" to develop a national identity. You'd never guess that today; the 555-foot-tall stone shaft has become one of the nation's most recognizable icons.

Yet, when a monument to the first President was included in Pierre L'Enfant's plans for the new capital city in 1791, Washington himself objected. He thought that government funds should not be spent for such a project. The trouble was compounded by the monument's original conception, an equestrian statue with Washington in Roman dress, a truncheon held in his right hand. To many Americans, the design smacked of monarchism and ostentation, inappropriate for depicting the man who was a role model of republican citizenship.

After Washington's death, battle lines hardened. The proposed statue was championed by the federalists, who favored a grand monument, and opposed by the republicans, who questioned the very act of commemorating a single hero. As the decades wore on, haggling continued. In 1833, a private monument society was formed, bringing in gifts of money and blocks of marble from states and individuals. Fifteen years later, the cornerstone was laid on the monument's present site. The society had decided on a predictably grand design by Robert Mills: an obelisk rising from a Greek temple, its colonnade encircling a vast rotunda that would house statues and murals of revolutionary heroes (p. 102). The decision was made to build the obelisk first, and by 1854 the shaft stood at 152 feet. But, that year, progress came to a complete halt when Pope Pius IX donated a block of marble for the monument. Objecting to the "papist

The building of the Jefferson Memorial precipitated the "cherry tree rebellion," as protesters fearing destruction of trees on the site chained themselves to the trunks; the politicians waffled.

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Now a peaceful host to summertime concerts on the Tidal Basin, for years the Jefferson Memorial was a Congressional battleground; finally, in 1938, a fed-up FDR pushed through the necessary funding.

gift," members of the antiforeign, anti-Catholic American Party, known as the Know-Nothings (SMITHSONIAN, November 1996), stormed the monument grounds, stole the papal rock and, it is believed, threw it into the Potomac. The next year, a group of them broke into the society's offices and seized its records. The project was enmeshed in chaos, and with the onset of the Civil War, work stopped altogether.

The marble stump stood for a quarter-century, a bleak rebuke to the young nation. In the early 1870s, with the centennial of the country approaching, Congress once again took up the issue of what to do with the unfinished obelisk. Some advocated tearing it down and starting over, and proposals flooded in for designs of towers ranging from English Gothic to Romanesque to a structure most closely resembling a Hindu temple.

The monument's completion in 1884, and its final design, owed much to the tenacity of Lieut. Col. Thomas Casey of the Army Corps of Engineers. As Congress bickered, Casey, who had been charged with supervising construction, drew up a new set of plans based on what had already been built. He envisioned a technological marvel equipped with electric lights and an elevator: an unadorned obelisk that would be the tallest masonry structure in the world. Somehow, this unsung hero persuaded the commission to dispense with the sculptural ornamentation originally planned for the base and, more amazing, to let him build the thing. A permanent reminder of the interrupted construction is the change in the shade of marble partway up—the original shade couldn't be matched.

In the decades following the Civil War, America overcame its democratic ambivalence to public sculpture. There was virtually no resistance, for example, to the Statue of Liberty, which was dedicated in 1886 on Liberty Island off the tip of Manhattan (SMITHSONIAN, July 1984). In fact, in the aftermath of the war, scores of towns and cities throughout the North, enjoying the fruits of victory and prosperity, rushed to erect sculptures that would commemorate their local heroes.

As the turn of the century approached, publishing tycoons emerged as influential monument builders. Indeed, one of the most dramatic controversies to enmesh a pair of public sculptures grew out of the rivalry between the Hearst and Pulitzer newspaper dynasties—and led to the construction of two monuments that now

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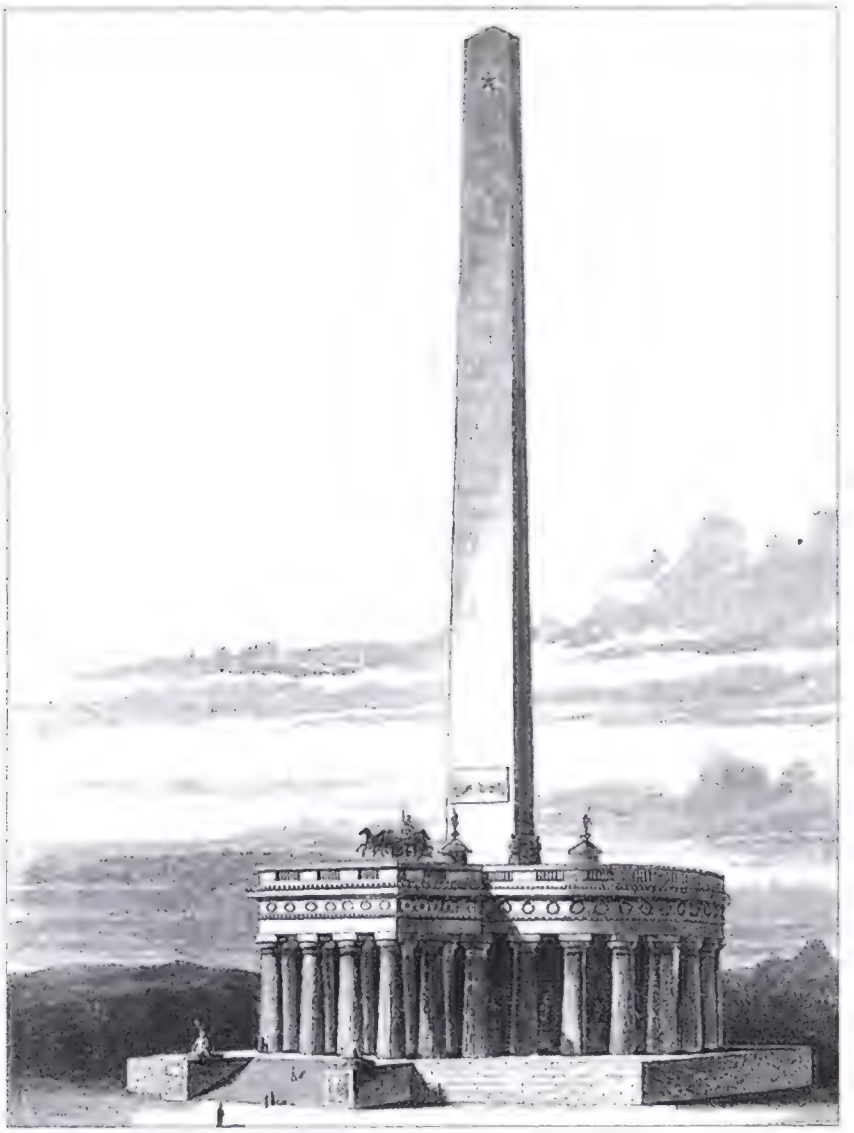

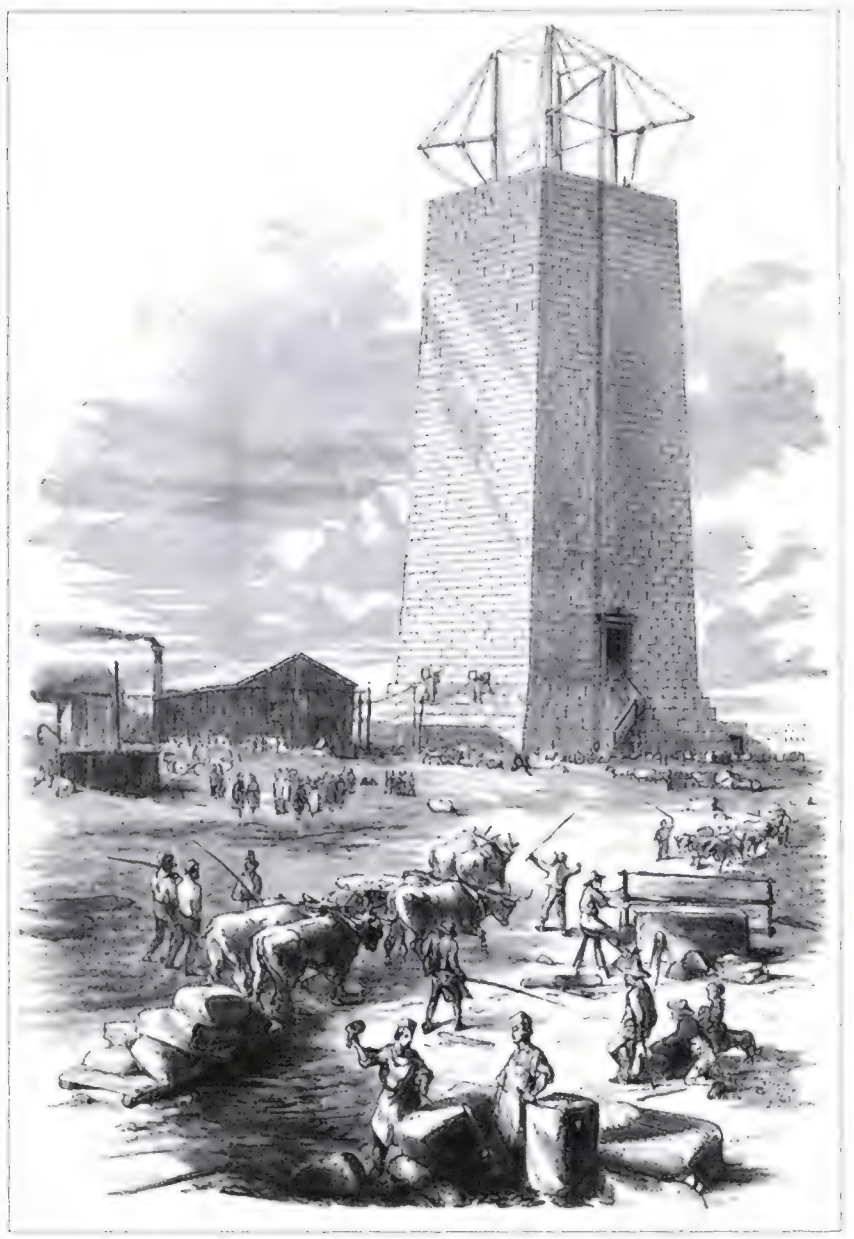

Plagued by funding woes and political squabbling, the Washington Monument (above, Robert Mills' 1848 design) sat unfinished for a quarter-century (below).

anchor the southern corners of Central Park, at 59th Street in Manhattan.

The fracas began with an explosion in Havana Harbor in 1898 that sank the U.S. battleship *Maine,* touching off the Spanish-American War. Within days, William Randolph Hearst launched a subscription campaign to raise money for a memorial, which eventually would be built at Columbus Circle. "Honor The Men Who Died For Their Country On The Battle Ship *Maine,*" blared the front-page headline of the *Evening Journal.* (A similar subscription campaign by the Hearst newspapers helped fund Mount Rushmore.)

To whip up support for both the war and the memorial, Hearst's papers also published distorted accounts of Spanish atrocities. At least, that was the judgment of former President Grover Cleveland, who had resisted intervening in Cuba during his Presidency, and who now refused to endorse Hearst's project. He would not, he avowed, "allow [his] sorrow for those who died on the *Maine* to be perverted to an advertising scheme for the New York [*Evening*] *Journal.*" Hearst had his fingers in other pies, too; his legendary battles with Tammany Hall and his political ambitions (he even ran for mayor against Tammany's candidate) delayed completion of the memorial for more than a decade.

While the political fights over the memorial eventually abated, a furor over its artistic merits raged until the end. Shortly before the monument was unveiled, the *New York Times* condemned the work as an "unsightly object . . . a monstrous combination of monumental masonry and plastic craftsmanship" with horses like "poor gored beasts of the Spanish bull rings vainly trying to regain their footing."

Meanwhile, not to be outdone, Joseph Pulitzer had also entered the fray as Hearst was locking horns with the mayor's office to get the *Maine* Memorial built. The Pulitzer Fountain was an exercise in simplicity, with its lone statue of Pomona, the Roman goddess of tree fruit. Proof perhaps that one can occasionally do the right thing for the wrong reasons, it met little resistance from either art critics or the public, and is now one of the best-loved public spaces in Manhattan.

If the heavy hand of two tycoons helped to redefine 59th Street, farther downtown the design of two lions outside the New York Public Library was undermined by the reticent personality of their sculptor, Edward Clark Potter. Shy and reclusive, Potter preferred animals to humans, at least as artistic subjects. Best known for crafting the bottom half of the equestrian sculptures designed by his more famous contemporaries, such as Daniel Chester French, Potter was a natural choice to

Andrea Gabor, who lives in New York City, is the author of Einstein's Wife: Work and Marriage in the Lives of Five Great Twentieth-Century Women *(Penguin, 1996).*

Portuguese Blues.

The blues that adorn the white houses of Obidos, 50 miles from Lisbon, are typical examples of local color. It's a feature beautiful enough to have been the inspiration behind a few songs and not all of them sad. But the painting is only one example of the area's inspirational beauty. Flower-laden windows, narrow stone streets, sun-drenched squares and a medieval castle, now a magnificent "Pousada," add color too. In other regions, such as Alentejo, white-and-blue houses prevail, where they contrast with the wheat-covered plains, the peaceful shade of the holm oak trees and the coolness of olive groves. Of course, it would be easy for us to go on singing the praises of Portugal. After a visit you'll be tempted to write a few verses of your own.

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Critics of the Vietnam Veterans Memorial were pleased by the addition of Frederick Hart's sculpture (above); the memorial (left) is the most visited in the country.

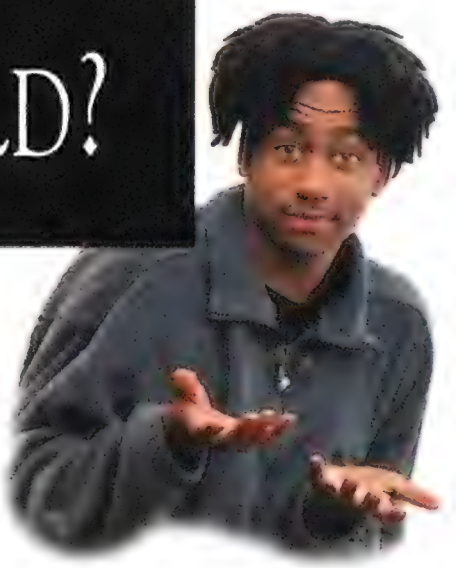
design the two library cats. But even before he had put chisel to stone, the cats were attacked. Theodore Roosevelt, who loved hunting big game, made it known that he favored elk or moose as guardians of the library. Another group lobbied for a pair of industrious beavers.

As Potter cold-shouldered newspaper reporters, the minor cat fight soon evolved into a leonine brawl, and the lions became scapegoats for a whole host of objections centering as much on the design of the library itself as on them. When they were finally unveiled in 1910, the press heaped insults on the two cats, deriding them as "absurd" looking and as "mealy-mouthed, complacent creatures." One reporter said they bore a likeness to the dour Norwegian dramatist Henrik Ibsen. *American Art News* printed a letter to the editor that said, "I have suspected for some time that the model of the good natured lions . . . was a stuffed one."

But within a few years of Potter's death in 1923, the pair of lions had won the hearts of the city dwellers, becoming a favorite rendezvous spot. In 1932, a *New Yorker* cartoon depicted a lion's rump inscribed with the following message: "Mr. Knox, I couldn't wait any longer. Mabel." During World War II, one soldier who was about to be shipped out and couldn't show up at a meeting with his girlfriend sent a telegram to her "Care of the North Lion, Public Library."

As a general rule, debate usually slows down the building of a monument, especially in Washington, D.C., where "debate as obstruction" is a high art form. In a notable exception, however, the most passionately contested monument in recent times—the Vietnam Veterans Memorial—was also built more quickly than any other in the city's history. The Vietnam Veterans Memorial Fund, announced by veteran Jan Scruggs in May 1979, attracted some powerful supporters, including a group of Vietnam veterans from West Point who enlisted the help of several key senators. But then the fund held a competition, in which a panel of art and architecture experts chose from among 1,400 entries submitted blind. Maya Lin's winning design, a polished, black granite wall inscribed with the names of those who died in Vietnam, was lambasted by critics as a "black gash" and a "tribute to Jane Fonda." Members of the selection panel were excoriated by author Tom Wolfe as "mullahs of modernism" responsible for the selection of this "enormous pit" as a memorial. Opponents of the design included Texas billionaire Ross Perot, who lost a close friend in Vietnam. It was a vicious debate, an argument that seemed to unleash years of pent-up rage and battling perceptions over the legacy of the Vietnam War. But, in the end, only 3½ years had passed from the beginning of fundraising until completion in 1982. In 1984, Frederick Hart's grouping of three soldiers, which was commissioned to mollify those who wanted a representational memorial, was positioned to face Maya Lin's minimalist wall, as though the soldiers, too, are reading the names etched into it. Today, the Vietnam Veterans Memorial is the most visited monument in the country. According to Bert Kubli and other public-art

WHERE IS FAIRFIELD?

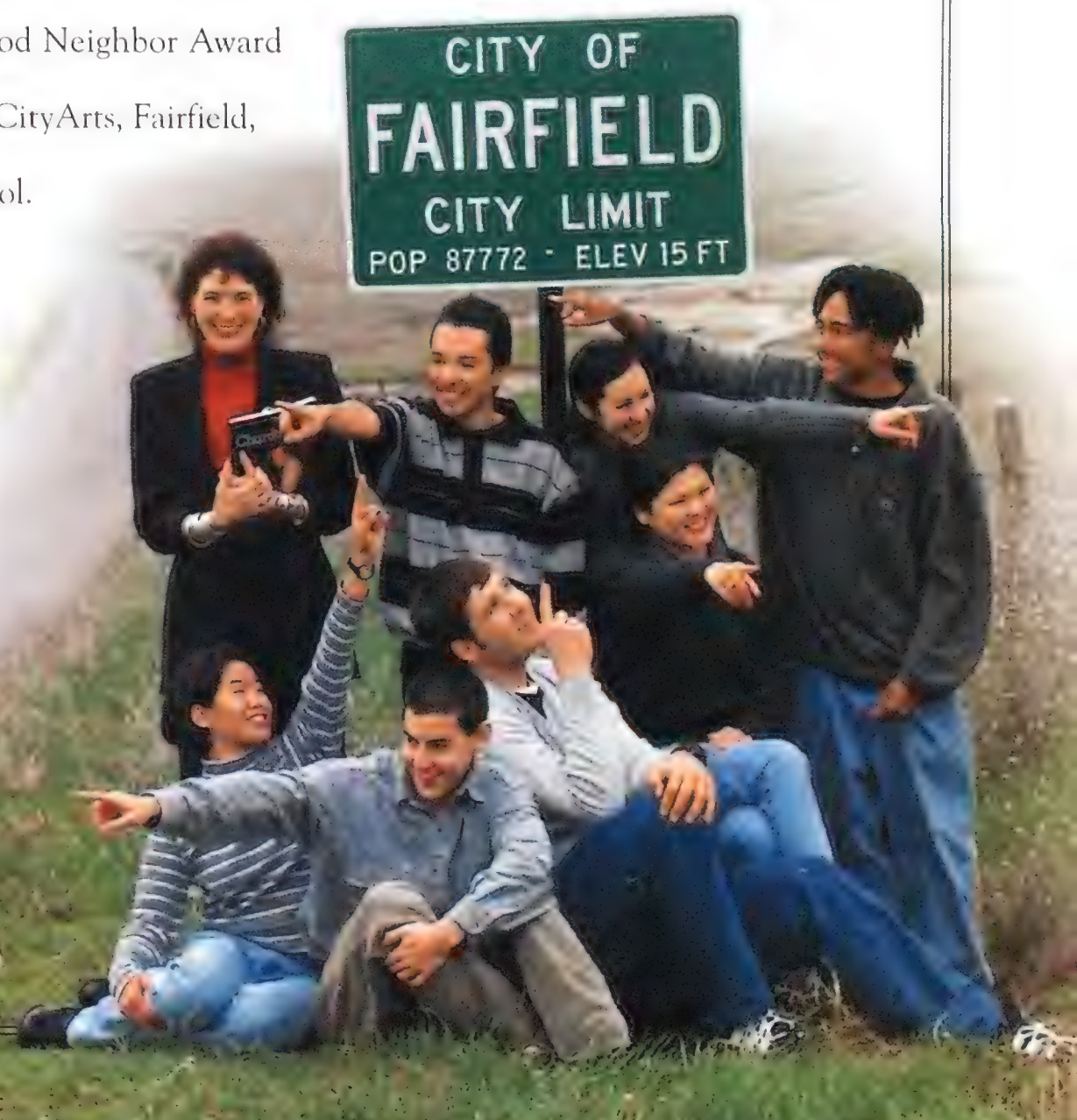


Actually, it depends on your point of view. "Where is Fairfield?" was a year-long public art project which challenged residents to think about their community's identity as more than just a dot on a map.

From the beginning, teacher Christine Vita Golik and her Advanced Placement high school art class made significant contributions. One student worked with town elders to compile stories which were used on city bus posters. Some students painted a temporary mural, while others built a series of chairs representing the ethnic and cultural diversity of Fairfield.

Mrs. Vita Golik used "Where is Fairfield?" not only as an innovative way to teach art, but as a means to demonstrate the value of community, commitment, involvement and collaboration.

For her efforts to enlighten both her students and her town, State Farm is proud to present Christine Vita Golik with our Good Neighbor Award and to donate a total of $5,000 to CityArts, Fairfield, California and Fairfield High School.



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Edward Clark Potter's New York Public Library lions would be elk if Theodore Roosevelt had won the day.

experts, the memorial benefitted from the debate that engulfed it. No other monument in America, says Kubli, is so clearly "the end product of a long, exciting, very democratic, and very American process."

With the completion of the FDR memorial, its builders hope that another spectacular round of controversy will come to an end. Since plans first were laid in the 1940s, this memorial has sparked many familiar debates. Critics have argued over its size (it now covers 7½ acres) and its cost (nearly $50 million). As the Depression and Roosevelt's stewardship during World War II faded from public memory, some questioned whether FDR deserved such a prominent tribute. The monument's design also came under fire. Two modernist plans of the 1960s—one of them derided as "Instant Stonehenge," and another an equally abstract and unpopular design by Marcel Breuer—were both jettisoned. Finally, in the 1970s, the more traditional design of Lawrence Halprin, a San Francisco architect (SMITHSONIAN, December 1988), passed muster with Washington's venerable Commission of Fine Arts, which reviews the development of all major monuments and public buildings in the nation's capital. Halprin designed a series of outdoor rooms, filled with figurative sculptures by Robert Graham, Neil Estern, George Segal, Tom Hardy and Leonard Baskin.

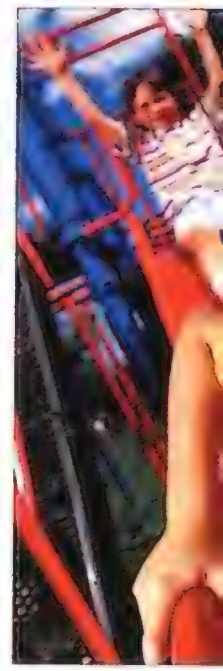
But even Halprin's widely hailed plan was not immune to special-interest politics. For example, a proposal for a sculpture of Eleanor Roosevelt wearing a fox-fur boa was attacked by animal-rights activists. The Commission of Fine Arts requested a substitute—a statue of her when she was the U.S. Delegate to the United Nations. During that time, she wore a plain cloth coat without any fur. FDR's cigarette holder is also absent. "That holder, often clenched in a toothy smile illuminating FDR's large, upturned head, was emblematic of the infectious jauntiness that was his greatest gift to a shaken country and a précis of his political philosophy," complained columnist George Will in the *Washington Post* a year ago. "But the cigarette holder must be banished, lest sin flourish."

In another dispute, disability advocates are unhappy that none of the sculptures of Roosevelt, who as a young man was stricken with polio, show him in a wheelchair. In Neil Estern's nine-foot-high sculpture, for example, a seated Roosevelt is draped in a cape. Estern says that, rather than hiding FDR's infirmity, the sculpture portrays it with subtlety; a pant leg slumping above the knee (p. 96) makes it clear that Roosevelt's thigh was withered. Elsewhere, in a bas-relief, the President is shown seated in a car. Curtis Roosevelt, FDR's oldest grandson, defends the designers' rejection of a blatant wheelchair depiction as consistent with what his grandfather would have wanted. "Even as a child," he says, "I would not have asked him about or made any reference to his paralysis."

Construction of the memorial started in 1994, after 40 years of design controversies. The final push came from the late Rep. Claude Pepper, who served as chairman of the FDR Memorial Commission from 1988 to 1989. Pepper rose from a hospital bed to deliver an impassioned plea to Congress to allocate funds for the project. A short time later, George Bush visited Pepper on his deathbed, and the dying Congressman and unrepentant New Dealer extracted a promise from the Republican President to see that the memorial would be built. Soon afterward, with urging from Bush, Congress allocated the bulk of the funds needed to start construction.

Lawrence Halprin says that he set out to design "not an object but an experience over time"; that he wanted to pay tribute to how FDR "faced challenges . . . and was able to effect solutions." In that endeavor, Halprin has surely been successful; the sylvan rooms ranged along the Tidal Basin are, indeed, a moving tribute to Roosevelt. But like George Washington, Roosevelt never wanted one. Four years before he died, FDR told Supreme Court Justice Felix Frankfurter that he would be happy with a memorial the size of his desk. "I want it to be plain, without any ornamentation," he told Frankfurter, "with the simple carving, 'In Memory Of . . .'"

It's for the birds, said the *New York Times* of William Randolph Hearst's pet project, the *Maine* Memorial.



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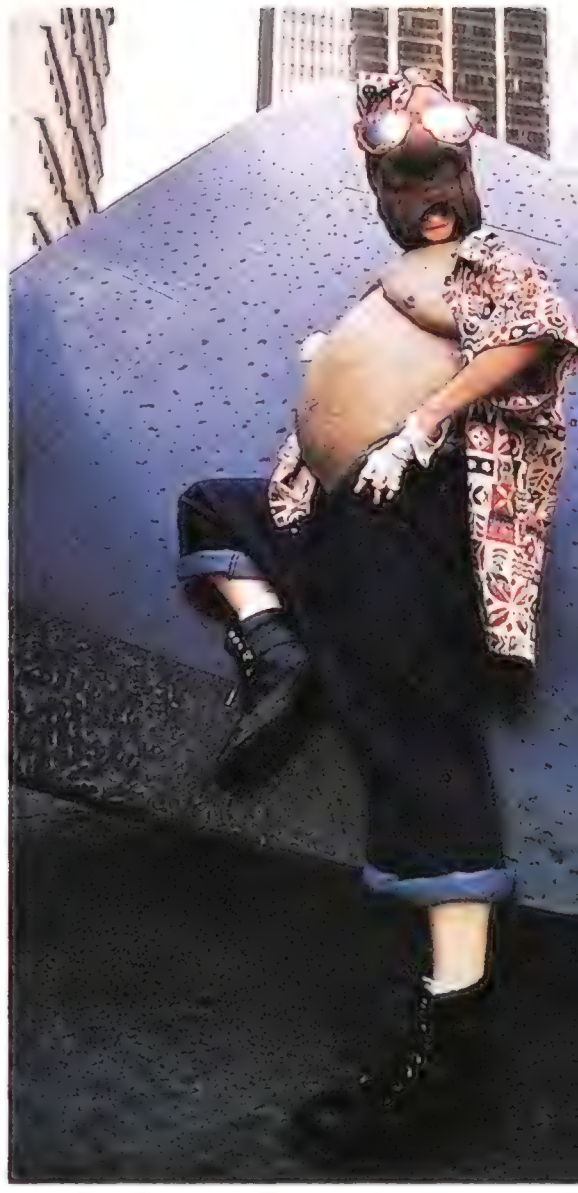

It's not easy to dumbfound a New Yorker. But drop a juggling tightrope walker into the middle of the financial district, and you can count on plenty of double takes. Next month, the juggler—along with more than 200 other street performers—will participate in Buskers Fare, a free festival held each year in Lower Manhattan to entertain tourists, residents and weary office workers alike.

Started in 1993 by the Lower Manhattan Cultural Council to celebrate the city's downtown neighborhoods, the Fare (this year, it runs June 10-14) showcases artists and acrobats, magicians and stilt walkers, puppeteers and knife throwers, from as far away as Spain and British Columbia. What's in store? Scenes from last year's Fare are leading comedic indicators. Stressed-out stockbrokers could sympathize with the member of San Francisco's acrobatic comedy troupe *Los Payasos Mendigos* (The Beggar Clowns) shown at right: talk about a piercing headache. A member of farcical masked puppet group Big Nazo (a corruption of the Italian word for "nose") strikes a pose at the World Trade Center Plaza (above, right). And the women of Pink, Inc. (above), an "art-in-motion" group from New York, provide some musical dividends as lip-synching girl group the Fortunettes.

These buskers (British slang for "street performers") follow in a long tradition: for centuries, villages in Europe have hired entertainers to boost business for local retailers. So keep your eyes on the Dow Jones Industrial Average once Buskers Fare '97 has played Wall Street.

Taehee Kim

This pair of buskers from England may not have good heads on their shoulders, but the worried-looking ones in their hands seem to suggest a bear market.

Scenes of busker madness (clockwise, from top left): "rock and roll puppet band" Big Nazo goes shopping; figures from school-zone traffic signs come to life in the Pedestrian Project; Big Nazo poses for family portrait; ballerina from Germany's Die Audio Gruppe records city sounds with electronic "tutu"; local puppeteer gives tots fine feathered fun; and Cornfield Dance kicks up a "Sidewalk Sonata."

By Mark Stuart Gill

Cybercops take a byte out of computer crime

A detective working the computer crime beat still needs street smarts, but there's a lot of uncharted legal territory out there

When San Jose, California, police raided an office last year, the suspect was led away smiling. He knew that the evidence needed to convict him—phone numbers, financial data, even e-mail—was protected by complex password software.

In years past, several months of police investigation would have been wasted. The officers didn't know anything about computers, and high-tech consultants were too expensive to bring in.

This time, however, the sergeant and his men waited for Keith Lowry to arrive. Within an hour, Detective Lowry of the high-tech unit flashed his badge and ducked under the yellow police tape that cordoned off the office. He pulled out a pair of white cotton gloves, a 35 mm camera and a couple of diskettes from a toolbox.

Lowry treats computers as carefully as corpses at a murder scene. That's because criminals often booby-trap their PCs so that a simple action, such as double-clicking the mouse, could send a command to delete data at the rate of 30 megabytes per second. Another ploy is to rig the door frame with metal strips that could (theoretically, at least) demagnetize the hard drive with a simple flick of the light switch. Although Lowry's never seen this succeed, the idea is that if anyone tries to carry out the computer, the magnetic field thus created scrambles the contents of the hard drive.

At the crime scene, Lowry immediately found the phone line that the suspect's computer was tied to and disconnected it. Then he started taking snapshots of everything and meticulously labeled the bundles of wires and cables behind the computer that's known as the "rat's nest." His final task at the scene was to carefully take the computer out of the building and to police headquarters, where he would secure the electronic evidence by performing an image backup, in effect making a copy of everything on the computer's hard drive.

Back at his office, with a copy of the confiscated hard drive before him, Lowry took a preliminary stab at cracking the password. First, he typed the suspect's name spelled backward and tapped the "Enter" key.

"Incorrect password," flashed the computer screen.

"I never employ a complex solution when a simple one will do," says Lowry. "The truth is, a lot of high-tech police work is just old-fashioned street smarts."

Lowry next tried entering the address number of the building where the computer was seized; then the suspect's license plate number. Neither of those worked. He decided not to waste any more time. He would run one of several specialized password-cracking programs that some Silicon Valley software companies distribute free to law-enforcement agencies. These programs, running day and night, can try millions of possible passwords.

But before he called his guessing game quits, Lowry removed a piece of paper that he noticed had been stuck on the back of the confiscated computer monitor. There, among scribbles and scratches of notes, the suspect had written down the password in case he forgot it!

In the parlance of police work, the fortyish Lowry is a "cybercop." One of only a few hundred in the country, he's fighting a worldwide technology crime wave that has been nowhere more intense than in Silicon Valley, the area around San Jose, where there are more than 5,000 computer-related companies. The area loses an estimated $1 million worth of components a week to theft. Though exact numbers that everyone agrees on are nearly impossible to come by, the total cost of technology-related crime, which can include everything from stolen laptops to data illegally obtained over the Internet, is high. One estimate puts it at about $8 billion per year nationally. Software piracy and component theft alone are estimated to cost over $24 billion worldwide.

Amid all the hype of the computer revolution, few people want to acknowledge that technology crime can pose a real threat to them. The truth is, today's world turns on electronic data whizzing through networks and stored in mammoth databases. Indeed, computer technology has become so democratic and user-friendly—Bill Gates' PC doesn't have any more capability than anything most of us can buy—that almost anyone can commit a crime or become a victim of one.

Keith Lowry once patrolled the streets of San Jose, California. Now he works in a more ethereal world.

Photographs by Gerry Gropp

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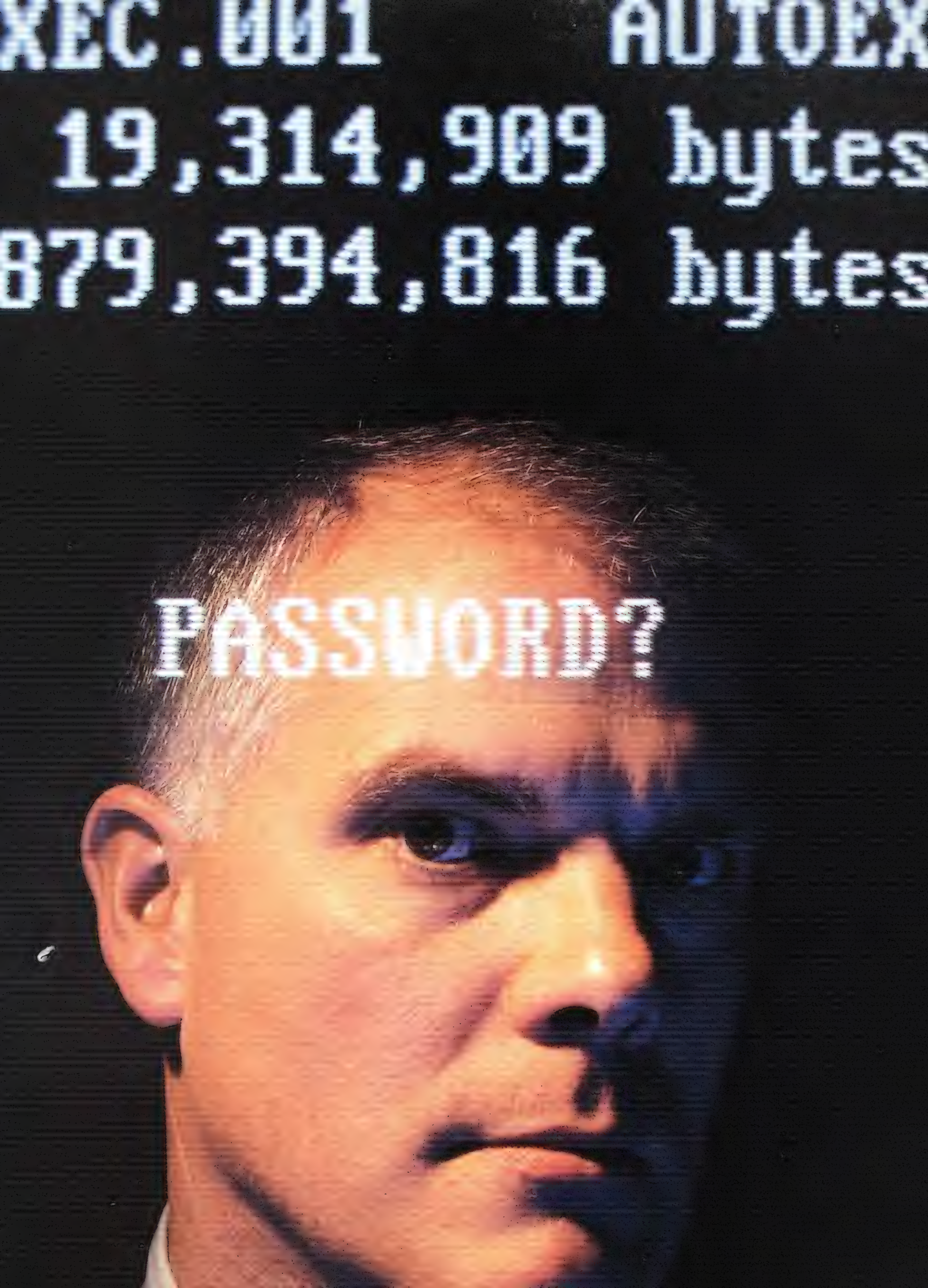


Ten to 15 years ago, computer crimes were rarely reported. Banks and other businesses were simply dumbfounded by the possibility of technology-related crime and placed little faith in police or the judicial system in prosecuting it. Moreover, "there used to be an unspoken stigma about computer crime," says Jim McMahon, one of the top computer-security experts in the country and Lowry's mentor at San Jose's high-tech unit. "For a company to prosecute computer theft was to publicly announce its vulnerabilities and invite copycats."

Things are different today. Lowry faces a backlog of hundreds of cases. There are so many that he sees himself less as a cybercop—a word he hates because it's "too Hollywood"—than as a 19th-century marshal trying to handle crime on the frontier.

"Cybercops work right in the middle of a torrent of legal, moral and political issues," says Rich Bernes, a supervisory special agent at the FBI's San Jose office who often works with Lowry. "Everything they touch sets a new precedent. Suppose someone accesses your computer and downloads files. What should she be charged with? Burglary or trespassing? Wire fraud or copyright violation?"

At 7 o'clock one morning, Lowry was already in his cluttered cubbyhole on the third floor of the San Jose police complex. Despite the early hour, the phone lit up. It was the security director of a company in Southern California. "We've got some really strange messages on our answering machine," the woman complained. Lowry did not know initially how that could possibly relate to him. But he opened a notebook and started to take notes.

The company's army of sales people used an "800" telephone number system with computerized voice mail. The voice mail was the backbone of the business. Hundreds of customers a day would call in and leave orders. A week before, the system had suddenly gone haywire. The sales force could no longer retrieve its messages. Customers couldn't leave orders.

"Computer glitch?" asked Lowry.

"We thought so," the security chief answered. "But we found dozens of messages that had nothing to do with our business. The messages were all for people in the San Jose area."

Now Lowry was intrigued. He ran through the basic questions he asks when he suspects an electronic intruder: "Was there anyone who was recently laid off or who might have some other grudge against the company? (No.) Was there any record of hundreds of calls accessing the system, spaced every few seconds? (Also, no.)

Next, Lowry listened to many of the voice-mail messages. It took several days, but he finally pieced together what was going on.

This New York author can be reached in cyberspace at markgill@sprintmail.com. He has written for such different publications as Rolling Stone, GQ *and* Worth.

An intruder had logged onto the computer through a telephone line. He may have gotten in by a popular cybercrime called "phone phreaking," in which a criminal uses a phone to fool a computer system into thinking that he or she is getting access legitimately. The intruder then has all he or she needs to seize control of even the best-guarded network.

In this case, the intruder had taken over the company's voice-mail system, turning it into his own giant personal answering machine. What's more, from the content of the new messages being left, he seemed to be selling or distributing the voice-mail service to unsuspecting users in San Jose.

Next, Lowry tried to track the intruder through the company's phone bills. When someone breaks into a voice-mail system, he often leaves fingerprints in the form of an automatically recorded phone number. Because of his chosen method, this person's tracks were obvious.

Sometimes shoe leather is best

Lowry fell back on some low-tech detective work. Using information from the voice-mail messages, he tracked down the addresses of users. He paid surprise visits to several. "I squeezed them for information, and they gave up the names of those higher on the food chain right away," says Lowry.

It took Lowry about a week, following a network of leads, rumors and victims, to find his way to the suspected "perp," who turned out to be a young male living in the San Jose area.

Lowry decided to run the name of the suspect through a specialized law-enforcement database. Such a database allows police in different jurisdictions to profile suspects and the crimes they commit by spotting trends in the way the crimes are committed.

One case in the Midwest attracted Lowry's attention. The computer system of a Michigan company that provided Internet services to the public had been breached. From the database he was using, Lowry saw that the San Jose suspect's name was attached to this case. The difference here was that before the owner of the Michigan company lost control of his system, he received an anonymous phone call.

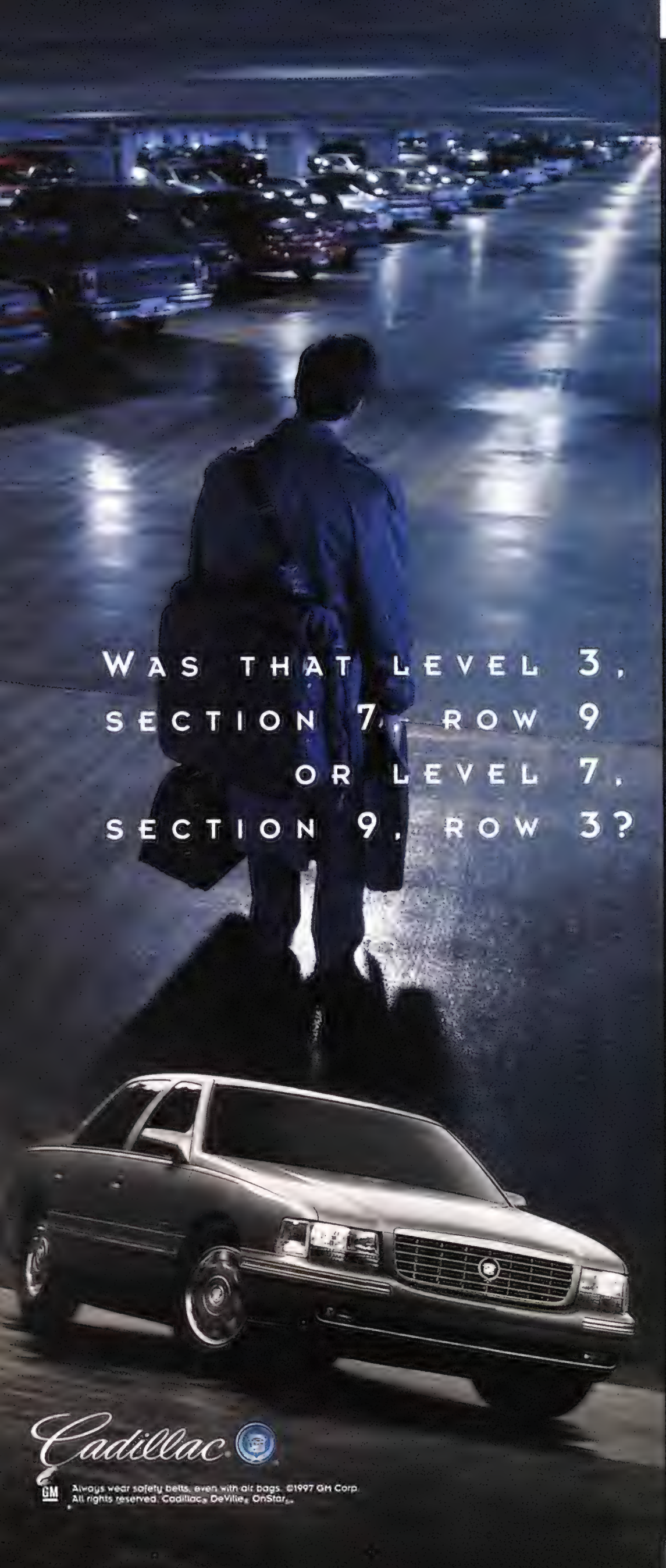
"We think you might want to hire us as security specialists for $20,000," the caller suggested.

"I don't need a security specialist," the owner said.

"You will after we take down your computer system," the caller replied.

The owner didn't take the caller seriously and hung up. Within ten minutes, all the computer monitors in the company went blank. His business had been wiped out.

One development in our digital era is the change in who such intruders are. Throughout the 1980s, they were mostly talented computer enthusiasts, often teenagers,



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who delighted in discovering the ins and outs of computer networks, and who often gained notoriety through attention-getting stunts. With their simple Commodore 64s, they would slip into military mainframes or thumb their nose at AT&T. They held national conventions and published newsletters to exchange information and brag about their exploits.

Nowadays, however, the criminals encountered in the world of high-tech crime are more likely to be out to make serious profits. They keep very low profiles. To them, technology-related theft—of software or components or information or access—is a business, not a hobby. "The average guy we arrest has got a bachelor's degree. They plot and plan; that takes a lot more skill," says Lowry.

Another difference today is the preponderance of what Lowry calls "computer-assisted" crime. "Sadly, crime is always going to occur," he explains. "But computers help some crimes occur faster and make them difficult to trace."

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Computers can make even the location of a crime less than obvious. About two years ago, for instance, a couple in Northern California were selling obscene material off their electronic bulletin board. Federal investigators in Memphis, Tennessee, were able to purchase electronic material from the man and his wife. The couple were tried in Memphis, far away from where they operated their bulletin board service. They were convicted of transporting, via interstate commerce, materials deemed obscene according to the local community standards of Memphis—crimes that carry maximum sentences of five years in prison and $250,000 in fines.

One contributor to the tsunami of computer and related technology crime is the miniaturization of electronic and computer components. Consumers love the convenience, but so do criminals. "In the '60s, the hard drive of a computer, responsible for holding all your data, was the size of a

Volkswagen," points out McMahon. "In the '70s, it was the size of a shoe box, but it still weighed a good ten pounds. Hard to put in your pocket and run with. Now, a hard drive is half the size of a pack of cigarettes."

Reselling computer components around the country is easy. It's not illegal to carry around a bag of computer chips, and until recently major manufacturers didn't want to take the time or expense to put a serial number on each one. What's more, some small stores and individuals—even some larger organizations—trying to stay alive in the fiercely competitive electronics business will purchase inventory off the street with no questions asked.

A year ago, Lowry spent a week conducting surveillance on a store that was buying up integrated circuit boards and memory chips from anyone who'd sell them. After videotaping several illegal transactions, he raided the shop and busted the owners. Even with half a dozen police officers milling about, thieves were still walking in off the street, trying to peddle hot merchandise.

Lowry worries that all this theft will eventually have disastrous consequences. "A faulty stolen chip could find its way into the control panel of a DC-10 or into the breathing ventilator when you're in surgery," he says.

Despite the rapid evolution of computer technology, Lowry himself works with modest, almost outdated equipment. The high-tech unit's annual budget hasn't risen in three years.

"The problem is that police chiefs want to see their men turning up strong eyewitnesses and physical evidence," explains Jim McMahon. "In computer cases, you turn up a lot of electronic impulses, unidentifiable equipment and crimes committed in hundredths of a second from hundreds of miles away." So computer crime winds up with nonviolent, low-priority status.

Worse, even when Lowry follows the letter of the law, conviction, even prosecution, can be elusive. A company may not want to reveal trade secrets or vulnerabilities in the public forum of a courtroom. Building a case against computer criminals can be difficult. And it doesn't help that there are only a few court opinions on the myriad misdeeds that fall under the category of "computer crime." Says McMahon: "It takes a lot of guts to make case law in computers."

Not surprisingly, one of Lowry's battles is fighting prosecutors who prefer to indict computer criminals under more conventional charges. In Fresno, for instance, a man who stalked women on an on-line service was initially arrested not for on-line harassment but for using fake credit-card numbers to pay for his time on-line and for illegal computer access.

Keith Lowry never imagined he'd be embroiled in these kinds of precedent-setting cases. After growing up in California and majoring in sociology at

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San Jose State University, he served briefly in the Marine Corps. He later worked for military contractors such as Lockheed and Martin Marietta as a communications engineer and business manager, specializing in voice and data communications.

In the late '80s, the defense boom began to wind down. Lowry, who has a wife and three children, decided to get out. He took a job as a police officer riding a patrol car in San Jose.

After making the grade into the high-tech unit, he became a point person for detectives in other divisions whenever they ran across a high-tech situation. On one occasion, a jewelry store was robbed. The crook had dropped a pager at the crime scene. The detective in charge put the pager on Lowry's desk and waited for the cybercop to perform some electronic miracle.

Lowry in fact electronically manipulated the device to obtain the pager's serial number and with that to track down the owner. He pointed out, however, that he could have simply called the paging company and asked them if anyone had called in a missing or lost pager or if anyone had canceled their service in the last 24 hours. That "anyone" would almost certainly be the clumsy crook.

What really attracted Lowry to the San Jose Police Department's high-tech unit, which he joined in 1994, was the street smarts you need to catch cybercriminals. By the third week of the voice-mail investigation, Lowry knew where the suspects (three had now been implicated) lived in San Jose. But he put off arresting them.

"I had to get some more facts," he pointed out. "Depending on what they had on their hard drives, I might not even be able to make a case for unlawful computer entry. I mean no one actually saw them hack into the voice-mail computer with another computer. So I couldn't connect a computer to the crime."

Besides, Lowry's investigation was telling a darker and darker story. Looking up more information about

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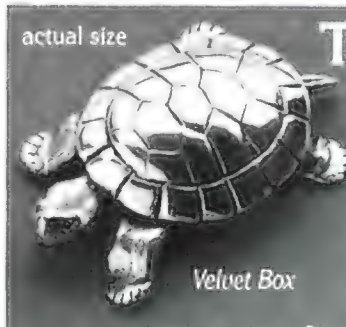

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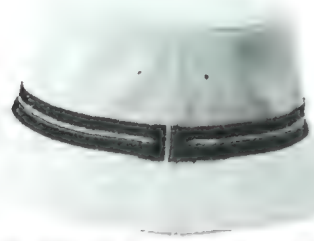

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each of the suspects, he found that elsewhere in California, they were associated with a case in which a university's computer had been accessed and files were erased. It took volunteers several days to replace the information that had been destroyed. In Great Britain, it appeared that a company had lost control of its computer system in exactly the same way as had the company in Michigan.

No one before Lowry had made the connection because the various local police detectives had mislabeled the cases and thus had not put the pieces together. Police were still investigating the intruder's extortion phone call as a "verbal harassment" case.

In truth, the computer intruders were planning to hold computer networks hostage, demanding ransom. "The concept of kidnapping data and information is too bizarre for a lot of cops," says Lowry. "But it's going to become a more and more common crime."

Three weeks after he began his investigation, Lowry convened a meeting in Santa Clara County with police officers and district attorneys from the local jurisdictions that were investigating the cases.

Arrest and search warrants for the three suspects were worded very carefully. That's not only because the suspects in this case were juveniles. It's also because computer searches and seizures are legally complex. Your computer, for instance, can be regarded as a filing cabinet, communication device and publishing tool all at the same time. Detectives can extensively search and confiscate automobiles used in the commission of a drug deal. But Lowry must keep careful watch on how computers and their contents are handled in investigations.

Just one month after Detective Lowry began investigating some funny answering machine messages in Southern California, and the process for executing a search warrant had begun, all three suspects surrendered. The evidence collected was overwhelming. All three pled guilty to charges includ-

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ing extortion, grand theft and unauthorized access to a computer system.

Lowry's tactics and techniques are applauded by many. But they are criticized by others who worry that police can abuse personal liberties using new technology just as easily as criminals can. A lot of people are wary of giving any agent of the government power to do anything with computers. For these people, cybercops are the enemy.

Nowhere is that more apparent than on the Internet—the electronic web of approximately 50 million regular users in 170 countries. The Internet has changed the nature and scope of computer crime. Easy and inexpensive access to cyberspace has let millions of people start using computers to trade stocks, gossip, pay bills, shop and do a thousand other things.

As the Internet sweeps the globe, carrying with it the potential to eradicate national and ideological as well as class and racial boundaries, Lowry admits it has proven harrowing for traditional law enforcement agencies to police. For starters, it may be difficult to determine where a cybercrime was actually committed. And it can also be hard to figure out where jurisdiction lies when pursuing a criminal in cyberspace. There may be, for instance, competing interests and laws between individual states or between one country and another.

Then, too, the Internet was designed to be unfettered by intervention. It began as a military project in the 1960s, to help support research in answer to a question of military strategy: What would happen if phone lines were sabotaged between the White House and military commanders? Unlike phone calls, which use individually dedicated channels, the web of communication lines that evolved into the Internet work differently. Messages are broken apart into "packets" and routed along any available channel, which at the same time carries packets from many other users. Each recipient's computer then reassembles the specific packets intended for her into a read-

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able message. In such a network, even if telephone communication is limited, a connection can be maintained easily.

Because expensive dedicated channels are not needed in this system, long-distance connections can be had for less than the cost of a local call. One result is that universities and federal agencies, as well as private corporations, have shown intense interest in it. In fact, since 1988, the number of users has doubled every year. And recently the major on-line services, such as Prodigy, CompuServe and America Online, have wooed millions of novices onto the Internet.

The Internet has also proved popular with criminals. But not in the way you might think. The most sensational crimes, such as the distribution of pornography, stalking or the planting of "viruses"—self-replicating codes that can disable a computer—are a small percentage of Internet crime. Those cases get an avalanche of media coverage, but the Internet is not an evil entity waiting to corrupt or destroy women and children. Most computer crime consists of such things as theft of trade secrets, software piracy, theft of intellectual property and cellular telephone fraud.

Even so, Lowry won't give out his own e-mail address, and he's intensely private about his personal life, because he's arrested criminals who know how to alter financial records at the major credit reporting agencies or jam an e-mailbox with thousands of repetitious messages, a tactic known as a "mail storm."

For added protection in cyberspace, many people want to use encryption whenever they are on-line. Before information leaves your computer, encryption software scrambles it. With the proper code, the intended recipient's computer can then unscramble it.

Software has been developed that is so inexpensive and powerful that everyone can encrypt what they write. One of the most popular programs, known as PGP (Pretty Good Privacy), can be downloaded from the Internet for free. Not even supercomputers can easily crack PGP. You can enjoy protection from criminal or malicious eavesdropping. But so can militant neo-Nazi groups and drug dealers.

In fact, the federal government saw widely disseminated encryption as such a threat that it classified American-made encryption software as a munition and limited its export by strict licensing. In December 1996, a federal district court judge in San Francisco ruled that the government's licensing procedure for such software violated the First Amendment.

At the same time, to better help law enforcement officials fight crime, the federal government encouraged standardized encryption by advocating the Clipper chip. The idea was that the chip's encryption procedure would be contained in American-made computerized machines. The Clipper chip, designed for use in phones and faxes,

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would have several "keys" to its encryption. Although all users and the people they communicated with would have keys, two other keys (each one half of an entire key) would be held in escrow by two "neutral" government agencies (the National Institute of Standards and Technology and the Department of the Treasury). Used together, these escrowed keys would be able to unlock information encrypted by the Clipper chip. Thus, the encryption would be impregnable to all but users and law officers who, with court authorization, could use the keys in combination to listen in on suspects. "It's no different from getting a warrant to wiretap someone's phone," shrugs Lowry. "You'd still need to show a judge justifiable cause."

That seemed to make sense. But several sea changes intervened. Response to the Clipper chip—from civil libertarians to big corporations—was so universally negative that the federal government has stopped advocating it. Corporations see huge profits in selling their own encryption systems, and civil libertarians worry about any government agency having the key to private communications. Companies can now more freely export encryption software as long as they provide keys that can be held by some neutral or third-party agent—or promise to develop encryption software that would. This helps answer corporate concerns about technology such as the Clipper chip hurting America's competitiveness abroad. Why would foreigners buy American-made phones or fax machines with a chip installed that would enable American law enforcement to access their information?

Electronic cash, one of the newest high-tech developments, also uses encryption. Many of us have heard about electronic transfer of funds, whether on a small scale (for instance, automatic teller machine cards used for grocery store purchases) or on a large scale (for instance, wiring money from one bank to another). But with electronic cash, users may carry prepaid cards with chips inside them (smartcards) or make purchases over the Internet with electronic "tokens," unique numbers that have monetary values assigned to them.

Despite powerful encryption, theft of electronic cash may become just another episode in the ongoing story of computer crime. "Electronic cash is going to change everything," says Lowry. "It makes it easier for people to get ripped off." With more and more people turning to the Internet for commerce, Lowry believes tools like the Clipper chip are needed by law enforcement to help combat the theft of electronic cash. International Data Corporation estimates that $117 billion in purchases will take place over the Internet in the year 2000. And with more than 400,000 commercial Web sites now on-line, real and potential monetary transactions over the Internet present a tempting target for the modern criminal mind.

Lowry picks up his laptop computer. "In the future," he smiles, "cops are going to need to know how to use these just as much as they need to know how to use a gun."

It may not look it, but this is the home of the high-tech unit of the San Jose Police Department. Sergeant Don Brister, right, suggests some legerdemain to Lowry as they try to reverse hack: break the suspect's code.

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Book Reviews

My Vegetable Love:
A Journal of a Growing Season
Carl H. Klaus
Houghton Mifflin Company, $22.95

I am not much of a gardener. I have a small patch of lettuce and tomatoes that I call my "salad," and a flower garden, smaller still. Some years the gardens do well; others they don't. I have no idea why. So it was not with a green thumb that I turned the pages of Carl H. Klaus' *My Vegetable Love.* But a gardener's touch was not required for enjoying a book that so wholeheartedly celebrates friendship, love, pets, the elements, family, academia, cooking, eating—and of course, gardening.

For 25 years Klaus, a professor of English at the University of Iowa, has cultivated vegetables on a three-quarter-acre lot in Iowa City where he lives with his wife, Kate. For just as long he has been asking himself "why I go through it day after day, week after week, month after month, year after year."

In search of an answer to his perennial question, the author kept a journal during the growing season of 1995, beginning March 16 when he planted his first radishes and onions and ending eight months later on November 24 when he lifted a row cover to find his remaining bok choy wearing a "hang-dog look."

As the months, and the garden, progress, Klaus discovers that keeping a daily journal can be a formidable task. "No longer do I feel free just to live a

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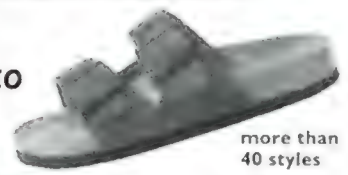

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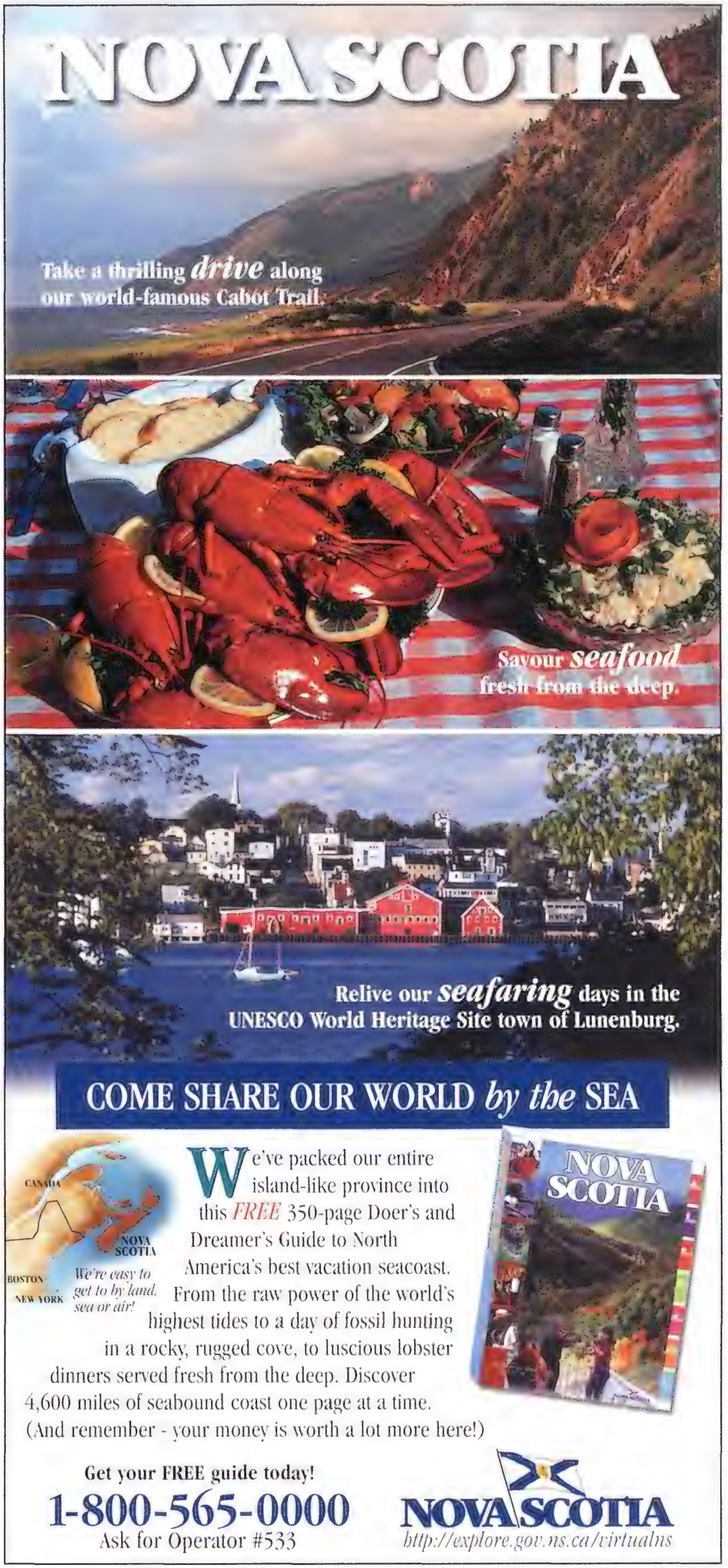
day without considering how the circumstances of the moment . . . will fit into the daybook," he writes; ". . . I garden to write, I eat to write, I think to write, I live to write. . . ."

A succession of family and friends pass through the professor's life. Rebecca, who helps Klaus and Kate in their gardens (Kate's flowers rival her husband's vegetables), has the delightful habit of showing up with a bottle of champagne tucked under one arm. Neighbor Jim drops down on all fours and rubs his head against the trunk of Klaus' dwarf cherry tree to illustrate how deer stripped its bark.

Though never stated outright, it is clear that to the author, Kate is the garden's most precious flower. Remembering their courtship some 30 years earlier, he writes, "How many times did I drive the twenty miles from Iowa City to Lisbon, by the rolling cornfields lickety-split, sometimes so fast I got picked up in Solon, halfway there, and taken to the local cafe, where I paid the speeding ticket right at the bar?" And a subsequent entry: ". . . I was standing at the back door watching Kate go from the terrace to the gazebo, placing her trays of seedlings on its sunny edge, just so, and then returning, her hair and her robe waving slightly in the breeze of her movement, her empty fingers pointing outward, just so."

As much as he loves to grow food, Klaus likes to eat food, and the lyric simplicity of his writing is well suited to describing the fruits of his labor: "a spinach salad that tasted so mild, some of its leaves so sweet and tender they reminded me of game fish caught in the chill waters of early spring." Radishes grew "so crisp and mild they tasted like spring rain."

The language of Klaus' garden spills into the language of his life. His students' theses "come to fruition." When the English department hires new, young professors, Klaus feels "like a late summer tomato in an early spring garden." When one fine day he declares, "And I myself felt as good as the soil," the reader knows that for Carl Klaus it doesn't get any better than this.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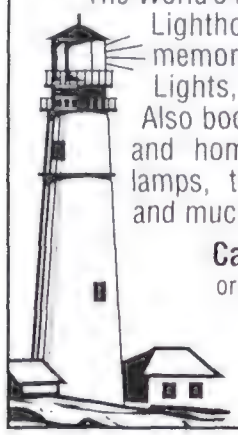
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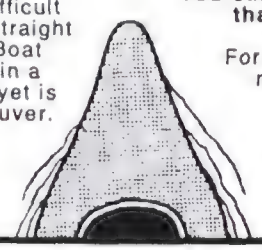

Though straightforward, Klaus' lean style can pack an emotional wallop. No one who has put a beloved pet to sleep can read with a dry eye his description of burying his 20-year-old cat. "There's a hump there now," he writes after tamping down the earth beneath the apple tree where he buried her, ". . . but Kate says that in time the hump will sink and the grass grow back until we hardly know it's there at all."

Near the end of the growing season Klaus notes, "It's only a vegetable garden, after all," but anyone who reads his book understands that it is far more than that. Just as anyone who reads his book will long for one of the meals so vividly described throughout—like the one planned around the last stir-fried snow peas of the season: "Charcoal-grilled mahi-mahi marinated in canola oil, lime juice, garlic, and our own lemon grass; steamed basmati and jasmine rich with chopped garlic chives from the herb bed; a special side dish of fermented black beans mixed with chopped ginger, hot pepper flakes, and oil that we prepared this morning; a bowl of fresh cherry tomatoes from the garden, standing by to cool our palates, just in case; and a salad of sliced cucumbers, marinated in a vinaigrette of sesame oil, rice wine vinegar, sugar, tamari, and Tabasco." As Klaus put it, "So much fuss was ne'er lavished over a bunch of pea pods."

Bon appetit—and good reading.

Reviewer *Emily d'Aulaire* writes from her home in Connecticut.

The Demon-Haunted World
Carl Sagan
Random House, $29.95
(Ballantine, $14, paper)

Einstein, History, and Other Passions
Gerald Holton
Addison-Wesley, $14 (paper)

The End of Science
John Horgan
Addison-Wesley, $24

Science and progress have seemed like synonyms for more than a century. From Newton to the astronauts, from Darwin to the genetic engineers, from Einstein to artificial intelligence, the search for scientific knowledge has produced stunning intellectual advances and applied technologies that have shaped our culture and our lives. Yet three recent books, from the heart of the scientific establishment, raise serious doubts about the future of science and explore the reasons for its apparent fall from grace.

In *The Demon-Haunted World*, the late astronomer Carl Sagan writes in defense of science and reason in a world he sees as darkened by ignorance, superstition, pseudoscience, deceitful advertising and mindless television. Physicist Gerald Holton's *Einstein, History, and Other Passions* focuses more on the political and academic attacks on science that have led to federal budget cuts in research funding and driven many PhDs from particle physics to careers as stockbrokers. And in *The End of Science*, John Horgan, a senior writer at *Scientific American*, interviews many contemporary scientists to show that science is in decline because it has answered all the important questions—not because of opposition from outside.

All three books deserve attention. The cultural crisis they address is very real, and involves political and economic choices that may reshape society. The decision by Congress to scuttle the superconducting supercollider project in 1993, after an investment of $2 billion on a 15-mile tunnel in Texas, is an example to which all these authors point. Similarly, cuts in the budgets of the National Institutes of Health (NIH), the move to abolish the Office of Technology Assessment, attempts to do away with the Bureau of Labor Statistics, and attacks on the research functions of the Environmental Protection Agency and other federal departments all reflect a shifting view of science and its public benefits, a shift from faith to suspicion.

Sagan, who was one of the leaders in the scientific search for extraterrestrial intelligence in the Universe, devotes most of his attention here to lamenting the lack of intelligence on earth. Like a modern Don Quixote, he waxes elo-

quent in defense of science while tilting at the windmills of pseudoscience, with thrusts at everything from Big Foot to Shirley MacLaine, alien abductions, satanic cults, astrology, telepathy and faith healing.

This may be diverting, but it is not because of such beliefs that Congress now approaches the NIH budget with an ax. In fact, billions of dollars spent on years of research in the war on cancer have spawned growing professional bureaucracies and diminishing medical benefits. There are many such examples of real problems that are eroding public faith in science, but they don't seem to exist in Sagan's universe.

As is the case with many scientists, Sagan splits his universe in two, into science and irrationality. "Truth" is only what can be experimentally proved, and "understanding" is only what fits into the logical straitjacket of a syllogism. This may work beautifully within the scope of questions that science can answer, but life is a far richer tapestry than the threads of scientific logic alone can weave. And it is myopic to define "reason" so narrowly that one can't see the other threads. An instance of this is Sagan's view of religion as dangerously close to pseudoscience (because it can't be tested experimentally) or, conversely, of science as a source of spirituality. He reasons that "to entertain the notion that we are a particularly complex arrangement of atoms, and not some breath of divinity, at the very least enhances our respect for atoms." It may not, however, enhance our respect for one another, or teach us much about compassion. There are some truths that science cannot measure.

Gerald Holton sees the roots of disenchantment with science in history, especially in the romantic movement of the 19th century. The contemporary upsurge of romanticism, he argues, has come in the form of postmodern philosophers, deconstructionists and others who attack the very idea of "objectivity" in general, and scientific knowledge in particular. Holton points to a report in the *Chronicle of Higher Education* that when the FBI circulated the Una-

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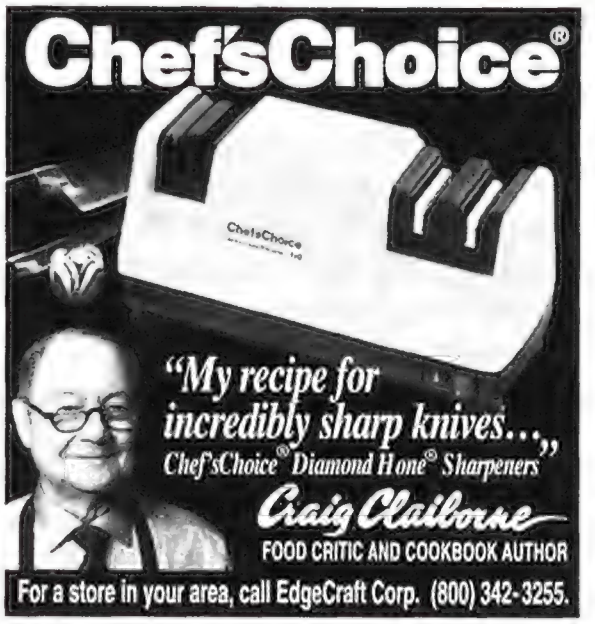

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bomber's antiscience and antitechnology manifesto among scholars, the text was judged as "consistent with the critical strain of scholarly thought" being applied by some historians to science.

The current rebellion has found political as well as philosophical expression, Holton points out. He quotes a widely circulated attack on science by the Czech poet, playwright and anti-Communist hero Vaclav Havel, who sees the troubles of the 20th century as caused by the rise of "depersonalized objectivity." According to Havel, "Communism was the perverse extreme of this trend. . . . The fall of Communism can be regarded as a sign that modern thought—based on the premise that the world is objectively knowable, and that the knowledge so obtained can be absolutely generalized—has come to a final crisis."

And in the United States, Holton notes, one of the strongest Congressional advocates of support for science, Rep. George Brown, was influenced by Havel's essay. In a dramatic reversal of his politics, Brown wrote: "Global leadership in science and technology has not translated into leadership in infant health, life expectancy, rates of literacy, equality of opportunity, productivity of workers, or efficiency of resource consumption. Neither has it overcome failing education systems, decaying cities, environmental degradation, unaffordable health care, and the largest debt in history." Not long after, Congress, seeming to follow a trend articulated by Brown, began cutting science budgets.

Holton's book combines essays on the crisis in science with sketches of Albert Einstein as an exemplar of scientific thought. He is trying to show that a life in science is not what its critics contend, but something more imaginative and profoundly human. But Einstein's humanity is not an answer to George Brown's list of complaints; it seems that Holton shares with Sagan a myopia that blurs their vision when they try to look beyond the world of science.

Holton simply casts Havel, Brown and other critics into the camp of irrationality and asserts that those who do not

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understand science do not understand the world. He writes of "the chilling realization that our intellectuals, for the first time in history, are losing their hold on an adequate understanding of the world. . . . All too many find themselves abandoned in a universe which seems a puzzle on either the factual or the philosophical level. Of all the effects of the separation of culture and scientific knowledge, this feeling of bewilderment and basic homelessness is the most terrifying." Reading this, I thought randomly of Picasso, Baryshnikov, Rostropovich, Lévi-Strauss, William Styron, Thomas Merton, Elie Wiesel, the Dalai Lama . . . and I could not think of them as bewildered and homeless, or as lacking an adequate understanding of the world. Neither Holton nor Sagan can see the poverty of his own view of the world; it is as if they are blinded by the splendors of what science can accomplish.

John Horgan, as a well-placed science writer, has compiled a remarkable set of interviews with many leading scientists in fields as varied as particle physics and cosmology, evolutionary biology and neuroscience, chaos and artificial intelligence, anthropology and the philosophy of science. Horgan thinks that science has discovered all the basic facts about life and the Universe. He cites Niels Bohr's quip that "science's job is to reduce all mysteries to trivialities" and argues that the job is essentially done; there are no more mysteries. "There will be no great revelations in the future," he writes, "comparable to those bestowed upon us by Darwin or Einstein or Watson and Crick." The surprising thing is that many of the scientists Horgan has interviewed seem to agree. It is for this reason, he suggests, that support and funding for science is falling off; it is simply the law of diminishing returns.

In advancing this idea, Horgan quotes physicist Sheldon Glashow who thinks that debates over superstring theory may one day be conducted "at schools of divinity by future equivalents of medieval theologians." Similarly, ex-physicist David Lindley argues that be-

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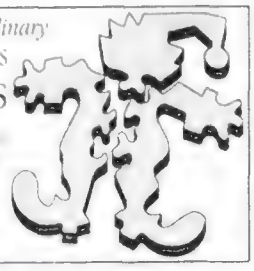

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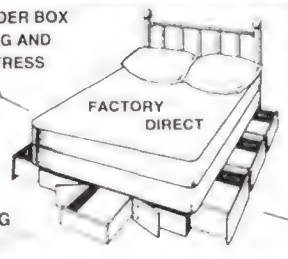
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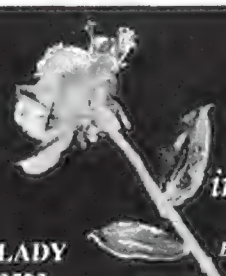
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cause new theories can't be validated by experiments, but only by subjective criteria such as elegance and beauty, particle physics is in danger of becoming a branch of esthetics.

We also hear from biologist Bentley Glass, who asserts that biology ends at the molecular level, and from the guru of artificial intelligence, Marvin Minsky. He contends that neurobiologists need no longer worry about the nature of consciousness: consciousness is a trivial issue, he tells Horgan: "I've solved it, and I don't understand why people don't listen." Consciousness, he declares flatly, is simply "a low-grade system for keeping records."

There's an air of unreality about all this. As Horgan shares his interviews and lets us eavesdrop on meetings at scientific think tanks, a reader may feel like an Alice who has wandered into a Wonderland of quarks and nucleotides and bytes, where conversations have no need for common sense. Unfortunately, the unreality stems not from an excess of imagination but from a failure of it. As Horgan buries biology, for example, that discipline is just beginning to explore the uncharted terrain of messenger molecules, replacing our concepts of the nervous, immune and endocrine systems with an as yet undeciphered language of peptides.

As with Sagan and Holton, the questions Horgan raises are more profound than his answers. The idea that science has run out of mysteries only trivializes both nature and the human mind. Darwin, Einstein, and Watson and Crick may embody the genius of science, but it is well to remember the anthropologist Gregory Bateson's definition: a genius is someone who is wrong, but no one knows it for a few hundred years.

Paul Trachtman is a reviewer living in rural New Mexico.

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mous piece of Presidential cheese. "Back in 1801," James Chenoweth tells us in his quirky travelogue *Oddity Odyssey*, "Baptist minister John Leland persuaded local farmers to contribute one day's milk toward making a colossal cheese for President Thomas Jefferson. On the appointed day, farmers came from miles around with donations collected from nine hundred cows. No cheese press was large enough to handle all the curds, so they used a reinforced cider press, but even that wasn't enough. The main cheese wheel was as big as a bass drum and weighed 1,450 pounds, while three smaller cheeses weighed 70 pounds each. The giant cheese was pressed for a whole month, then carefully removed from the press and ripened for many weeks in a cheese house. It had to be turned over daily without cracking it. After being safely transported by land and water, it arrived at the White House in a cart drawn by six horses and bearing a sign: THE GREATEST CHEESE IN AMERICA FOR THE GREATEST MAN IN AMERICA. When it was presented to him on New Year's Day, 1802, in the East Room of the White House, President Jefferson quipped that the cows must have all been Republicans and gave Leland two hundred dollars rather than accept a gift from poor farmers. As he cut the first slice, the president said, 'I will cause this auspicious event to be placed on the records of our nation and it will ever shine amid its glorious archives.' The cheese continued to be served at the White House for the next three years."

The anecdote is one of dozens sprinkled throughout Chenoweth's informative and highly eccentric guidebook. *Oddity Odyssey* offers an agreeably offbeat tour through the New England states, chronicling historical curiosities, architectural wonders and colorful personalities of the past. Among the more notable figures encountered is Dr. John Wilson, who, having designed in 1823 what Chenoweth describes as the only round schoolhouse in America, later proved to be a notorious outlaw known as "Captain Thunderbolt." (That legendary highwayman had roamed the Irish countryside and the Scottish-English border for nearly a decade, beginning around 1810. There, he "robbed from the rich, gave to the poor . . . and became the toast of the little people.") Equally memorable is William "Snowflake" Bentley, who labored for years in his frigid Vermont workroom to produce some 5,300 photographs of individual snowflakes—leading him to conclude that no two were alike.

Over the course of 158 pages, Chenoweth balances these historical nuggets with present-day oddities such as the record-breaking 4,817 jack-o'-lanterns assembled in 1993 for the annual Harvest Festival in Keene, New Hampshire. The author does his best to offer practical travel advice, but most readers will be far more interested in Chenoweth's outlandish collection of stories from the distant past, like that of a strapping farm girl named Deborah Sampson, who, Chenoweth says, became the first female soldier in the Continental Army during the Revolutionary War. "Stirred by hearing the Declaration of Independence read aloud, Deborah passed herself off as a man and enlisted in the Fourth Massachusetts Regiment under the name of 'Robert Shurtleff,'" Chenoweth recounts. "Her rigorous farm chores had given her the strength to carry her firearm, bayonet, hatchet, cartridge box, buckshot and leaden balls, flint and powder, jackknife, canteen, haversack, and blanket. Legend has it that Deborah was at Yorktown when Cornwallis surrendered. That is not true, but she did take part in several military battles and was wounded during one at Tarrytown, suffering a saber slash in the head and at least one bullet, perhaps two, in her thigh. Desperate to avoid medical examination that would reveal she was a woman, Deborah focused the surgeon's attention on her head wound and secretly extracted the bullet or bullets in her thigh by herself. It wasn't until several months later, during action at Philadelphia, that Deborah's secret was discovered when she came down with typhoid fever. While she was unconscious, a startled doctor unveiled her bound breasts. He kept her secret while she recovered, but insisted that General Washington be told. She received an honorable discharge in 1783 but without the usual soldier's pension. Paul Revere aided her in securing a small pension and some back pay."

For the most part, the well-chosen anecdotes will leave the reader wanting more, as in the case of Boston's mysterious "Flying man," who apparently took flight from the steeple of the city's Old North Church on two occasions—both in 1757. The means by which he accomplished this remarkable feat are not specified in the newspapers of the day, but a plaque in the churchyard records the event: "Here on September 13, 1757, John Childs who had given public notice of his intention to fly from the steeple of Dr. Cutler's church performed it to the satisfaction of a great number of spectators."

Chenoweth, too, has performed his task in a manner likely to bring satisfaction to a great number of spectators.

Daniel Stashower is a freelance writer who is based in Washington, D.C.

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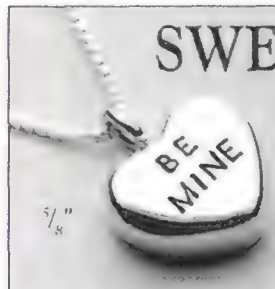

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SMITHSONIAN (issn 0037-7333) is published monthly by the Smithsonian Associates, 900 Jefferson Drive, Washington, DC 20560.

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Editorial offices are at 900 Jefferson Drive, Washington, DC 20560. (202-786-2900). Advertising and circulation offices are at 420 Lexington Ave., New York, NY 10170. (212-490-2510)
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By Robb White

To protect yourself in a world full of peril, you have to dress for safety

I've been obsessed for most of my adult life with personal safety devices. The cause of this is probably early exposure to terror. My first job was in a sawmill. (The only thing in my experience scarier than that place was the hangar deck of an aircraft carrier during blacked-out night operations.) Saws with no guards, miles of belts running wide open, forklifts trying to run you over, horrendous noise levels—if you can think of a hazard, the old mill had it. Luckily, the sole injury I suffered there was from a grasshopper that crawled into my ear one day and kicked a hole in my tympanic membrane. Now, I always wear earmuffs on the job, or whenever I'm around grasshoppers.

Actually, I'm addicted to two kinds of hearing protection. I have a pair of big plastic earmuffs that I wear for short, loud jobs. I also have a set of little plastic-foam sponges that I roll up and stick in my ears, where they expand and shut out the noise. These are for when I have to be in a noisy situation for a long time.

I've become secretive about the little sponges. I conceal them in a container that I hide in my left pocket. I can sneak them out of the container and roll them up while my hand is still in my pocket; it then takes only an instant to insert them when no one is looking.

I began this secrecy after my granddaughter exclaimed at how dirty the sponges are. She was right. They are dirty. But once they're in place, no one can tell. I now find that I like to wear my earplugs in public places, where occasionally I embarrass myself by shouting at clerks and other people because I can't hear how loud I'm talking.

I also have a thing about safety glasses. No doubt this, too, derives from the fact that I've always worked in the kinds of jobs where a person could lose or damage an eye in no time. I used to feel uncomfortable whenever I didn't have my safety glasses on. By now my eyesight has degenerated to the point where I have to wear real glasses all the time. No problem. I have a couple of removable side guards that I can clip onto the earpieces, thereby transforming my ordinary glasses into, in effect, safety glasses. I'm so accustomed to my side guards that if I don't have them on I become alarmed by too much peripheral vision. I think I see things passing close by when they aren't. In fact, I've incurred several cricks of the neck from turning my head too rapidly to avoid imaginary missiles. That's why I keep my side guards on all the time.

I'm not the only one who obsesses on personal safety. Recently I bought a new hammer with a little sticker on it that says: "Caution: Always wear eye protection when using this tool as chips of steel may fly into your eyes." The next day, I had to go to the patent attorney to see if any of my brilliant ideas had paid off yet. There in the waiting room was a man with a hammer just like mine, except that on the business end of it he had stuck one of those little sink-style plumber's friends. I had to ask him about it.

The man told me that the plunger cup was a safety device that would prevent bits of steel from flying into someone's eye. "I know what you are wondering," he said. "You are wondering how the user of the hammer will be able to see the nail. Well, when we get into production, this guard will be made of transparent vinyl instead of black rubber." I asked him to send me one as soon as it came on the market.

I mustn't neglect to mention my rubber gloves. I'm a boatbuilder and I wear rubber gloves for two reasons: first, because of all the toxic glues and other stuff I have to work with, and second, because of all the advice my customers want to give me.

I don't know why, but people feel compelled to give advice to boatbuilders. When they go to the dentist, they just sit there in the chair and don't offer him any advice at all. When they go to the doctor, they don't try to tell him how to run his business. I used to think that the reason we laboring folks don't advise professional people had something to do with the fact that they went to school longer than we did or made more money or had receptionists. But I finally figured out the real reason. It's those rubber gloves they wear that intimidate us! So whenever visitors to my shop start crowding around to tell me how to clench a tack or smear glue, I just whip out my rubber gloves, pull them on and watch those would-be advisers head for the sidelines.

I started getting serious about respiratory safety around the same time I began using modern finishes. I was out painting a boat in the yard one morning when I noticed that dragonflies 20 feet up in the air were plummeting to earth as if they'd been shot. In the old days bugs seemed to be attracted to regular varnish, but the smell of the new stuff was chasing all the whiteflies out of the gardenia bushes.

That was enough for me. I went to town and bought the best face mask I could find. A wise purchase, it turned out. The other day, while I was at a Little League baseball game, I was trying to decipher what my wife was telling me by reading her lips when a foul ball caromed off the steel toe of my safety shoe and hit me smack in the face. Fortunately, I was wearing my twin-canister, federally approved organic vapor mask. I didn't feel a thing.

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Graduation gift from parents, who hoped it would be used for writing resume. Actually used to keep journal of travels through Europe.

1988

Gift from girlfriend, to celebrate first job. Used to write her a Dear John letter after discovering initials belonged to another boyfriend.

1991

Gift from co-workers to celebrate leaving and starting own company. Used to sign away house, car and retirement account as collateral for bank loan.

1993

Bought to draw up first multi-million dollar deal, which put company on industry "top ten to watch" list. Also used to write check paying off bank loan.

1996

Gift from employees to celebrate early retirement after IPO raised twenty-five million dollars. Used to keep journal through Europe.

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